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ABSTRACT

Primarily written for school administrators and driver education teachers, this publication presents information on planning and implementing the multiple car method of driver instruction. An introductory section presents a definition of the multiple car method and its history of development. It is defined as an off-street paved area incorporating a variety of realistic traffic situations which will develop the identification, prediction, decision, and execution abilities of driving. A second section presents guiding principles for planning a multiple car facility, including facility size, cost considerations, site selection and development, facility design, and equipment. A third section provides information on planning and implementing instruction, including an instructional plan and a ten-lesson outline as a sample time allocation plan. An appendix includes diagrams of three different multiple car facilities, brief descriptions of seven practice situations, skills and procedure evaluation check sheet, checklist for evaluation of drivers, and a sample practice driving guide lesson. (BL)

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THE MULTIPLE-CAR METHOD

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Exploring Its Use In Driver and Traffic Safety Education

American Driver and Traffic Safety Education Association
Washington, D.C.

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THE MULTIPLE-CAR METHOD

Exploring Its Use In Driver And Traffic Safety Education

Second Edition

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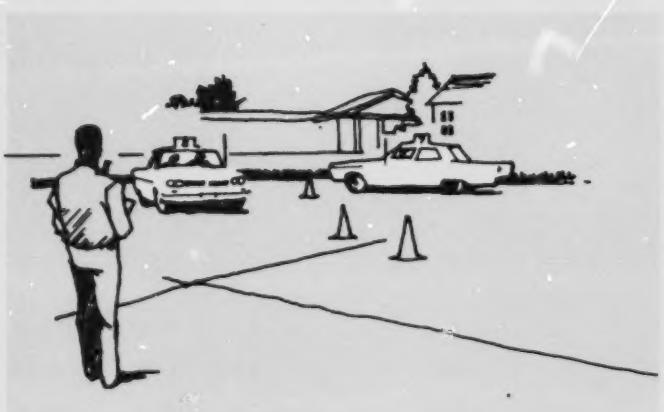


Preface

The multiple-car method was first used as part of a driver education program in 1936 at Chicago's Lane Technical High School by William A. Sears, a teacher at the school. Interest in the method was stimulated during the late 40's and early 50's, primarily through the efforts of Gordon C. Graham, who, after observing its operation in Chicago, incorporated it into the Detroit schools. Today, 642 schools in 36 states utilize facilities on which some form of the multiple-car method is reported to be in use (18).

In recent years, attention has been directed toward development and refinement of various teaching methods. Research studies have been made, and numerous schools have adopted the multiple-car method in various forms. Some reference to this instructional approach may also be found in college texts.

These recent developments have coincided with a growing need both for expanding driver education programs to reach all eligible youth, and for improving instruction. While it is unlikely that there is *one* best method to meet this quantitative-qualitative challenge in driver and traffic safety education, the intelligent use of the multiple-car method does hold much promise.

In an attempt to close the knowledge gap regarding the multiple-car method, and to provide guidance to those considering the method, the Automotive Safety Foundation authorized preparation of the First Edition of this publication in 1967.

Educators experienced in the multiple-car method planned and prepared the basic content of the publication. The contributors listed below are directly involved with the method in a teaching, research, or administrative capacity in a high school, college, university, state education department, or supporting agency operation:

Dr. Richard W. Bishop, Florida State University;

Dr. Charles H. Hartman, then with the Automotive Safety Foundation;

Dr. Francis C. Kenel, then with Illinois State University;

Gene MacDowell, then with Horseheads High School, New York;

Dr. Robert O. Nolan, Michigan State University; and

William T. Richards, Wisconsin Department of Public Instruction.

Developments since the preparation of the First Edition dictated a revision. The initial publication was subsequently critiqued by a group of educators and traffic safety personnel who made many valuable suggestions and comments which were later incorporated in the present Edition. These reviewers were:

Dr. Richard W. Bishop, Florida State University;

Dr. Gary J. Bloomfield, Eastern Michigan University;

Dr. LeRoy Dunn, National Highway Traffic Safety Administration;

Richard D. Ellis, State University of New York at Albany;

Calvin M. Faulkner, Baltimore Public Schools;

Dr. Francis C. Kenel, University of Maryland;

Donald J. Klusendorf, Reavis (Illinois) High School;

Howard Matthias, St. Cloud State College;

Monroe Mayo, Colorado Highway Safety Programs;

Dr. Charles E. McDaniel, Appalachian State University;

Dr. Robert O. Nolan, Michigan State University;

Dr. Philip J. O'Leary and Richard E. Claflin, Michigan Department of Public Instruction;

Dr. W. Laurance Quane, Illinois State University;

Dr. Milton D. Rhodes, Oklahoma State University;

Dr. August J. Schulz, Stout State University;

Dr. Robert A. Ulrich, Central Missouri State College; and

Dean Wilson, Pontiac (Michigan) Public Schools.

The contributing authors for this Edition are:

OWEN L. CRABB
Driver Education Specialist
Maryland State Department of Education
Cockeysville, Maryland

ARTHUR A. OPFER
Manager, Highway Safety Department
Highway Users Federation for Safety and Mobility
Washington, D. C.

*ALLEN R. ROBINSON
Highway Safety Specialist
Highway Safety Department
Highway Users Federation for Safety and Mobility
Washington, D. C.

DR. DONALD L. SMITH
Assistant Professor
Michigan State University
East Lansing, Michigan

* At this writing, Mr. Robinson is on leave of absence from the Federation completing work on his doctoral program at Michigan State University.

Editorial assistance and technical production services were secured from Federation Public Information Division staff members, John Rountzounis and Hays Browning, Jr. Miss Esther Sibal, secretary, Highway Safety Department, provided secretarial assistance on this publication revision.

The generous contributions of these many people proved valuable, and their assistance is gratefully acknowledged. The authors alone, however, assume responsibility for the contents.

This publication has been written primarily for educators. The school administrator may be most interested in the sections relating to costs, scheduling, equipment, effectiveness and a host of related topics. In addition to these, the teacher will perhaps give close attention to instructional planning and the myriad of related techniques, methods, and decisions that can either enhance or cripple a program. Teacher educators may find the publication useful in orienting their students to the multiple-car method of instruction. Laymen interested in driver education may also find the publication beneficial.

The primary concern of this publication is the multiple-car method. Others methods (e.g., simulation) are given only indirect attention. Subsequent sections will describe some policies and practices for the multiple-car method as they have been used with apparent effectiveness. The authors have attempted not only to describe, but, in some instances, to interpret findings and offer tentative conclusions. These conclusions are neither sacred nor offered as "national standards." They represent the considered judgment of the authors whose aim has been only to help those considering the multiple-car method.

The authors attempted to treat issues known to be pertinent to this instructional method. Since available data were not sufficient to permit a definite position on all issues, some unanswered questions remain.

Despite the lack of "final answers" for all situations, there is good reason for optimism and confidence regarding the multiple-car method. This publication has been prepared as background for educators and laymen who wish to plan and implement more meaningful instructional programs. It is offered as a contribution to the professional improvement of driver and traffic safety education, and it is dedicated to those who work toward achievement of this goal.

Introduction

Objectives of Driver Education

The primary goal of driver and traffic safety education is to provide learning experiences that will improvement the quality of human decisions and performance tasks related to the highway system in a manner which encourages continued improvement (3).

Specifically, the primary aims of secondary school driver and traffic safety education are to:

1) prepare students with at least minimum performance capabilities for entry into the highway traffic system as vehicle operators;
2) equip students with knowledge and thought processes that will *enable* them to make wise decisions in situations that could lead to impaired driving performance (alcohol, drugs, fatigue, emotions and vehicle maintenance); and
3) help students acquire the insights and motivations needed to *become* fully functioning operators and responsible members of the system. (3)

Since its inception driver education has aimed at these goals by utilizing a combination of classroom and laboratory instruction.

Laboratory Instruction Developments

Traditionally, laboratory instruction consists of a teacher instructing from two to four students inside a properly equipped driver education vehicle operating on public streets and highways. One student drives while the others observe and sometimes participate more actively by answering questions, recording observations, or evaluating driver behavior. Instruction follows a systematic pattern beginning with lessons emphasizing the manipulative (execution) skills of the identification, prediction, decision, and execution (IPDE) process and progressing to those lessons that emphasize the development of those identification, prediction, decision-making, and execution abilities required for effective motor vehicle operation in traffic mix situations.

This particular method has great appeal because of its inherently close student-teacher relationship. *And, unquestionably, this method does afford students many opportunities to develop manipulative and perceptual skills important to safe driving.* Moreover, the teacher can evaluate student behavior promptly and, when necessary, can verbally or physically correct student actions on the spot.

Evolution of Laboratory Instruction

Driver educators have known for a long time that some beginning students learn more readily in a controlled environment during the early lessons of on-road instruction. Many teachers fulfilled this need by using deadend streets, deserted parking lots, etc., to conduct early lessons. In this setting the student could concentrate on and improve his basic manipulative skills. Most of these activities, though classified as on-street instruction, were in reality off-street instruction.

From this fundamental approach the concept of a multiple-car method of instruction has evolved. That educational need, combined with increased pressure to provide driver education for all eligible students (state and federal mandates) at a lower per student cost, have been the driving forces behind the development of multiple-car facilities for driver education.

Meeting the challenge of providing comprehensive driver education entails a reappraisal of teaching methods and concepts, innovations in laboratory instruction, and a more efficient and economical utilization of qualified teachers.

The multiple-car method offers an important step in this direction.

Defining the Multiple-Car Method

Considerable confusion exists over the description of multiple-car facilities. Some multiple-car facilities are little more than parking lots, athletic fields, or similar areas used to supplement on-street driving instruction. These areas are used primarily for beginning lessons and for initial driving experience away from on-street traffic conditions. In some schools as many as three or four dual control cars, with a teacher and two or three students in each car, may all use such an area at the same time. Whatever value these areas may have, they are not truly representative of the multiple-car facility, nor should they be so labeled.

Specifically, the multiple-car method is defined as: *an off-street paved area incorporating a variety of realistic traffic situations which will develop the identification, prediction, decision, and execution abilities of driving.** While the development of manipulative skills is basic to the multiple-car method, the student's ability in a "traffic mix" situation to identify, predict, and decide must also be emphasized.

* As defined by the authors.

The physical characteristics of a multiple-car facility should include:

a. areas designed for the development of the human functions of driving;
b. road surfaces wide enough for two-way and multiple-lane traffic and long enough for passing;
c. intersections, curves, grades, merge, diverge, skid pan, and off-pavement; and
d. lane markings, signs, and signals.

Physical characteristics, however, are not the sole criteria for designating a multi-car facility. *It is the manner in which the facility is used* that determines whether it can truly be called a multiple-car facility.

The multiple-car method permits several automobiles to be operated simultaneously on a special off-street facility, under the direction of one teacher positioned *outside* the vehicles. The teacher, typically, communicates with students by radio.

This approach increases the teacher-student driver ratio from 1:1 to 1:X. The unknown "X" will depend on the number of vehicles used. Generally, maximum economy and driver interaction are achieved when six or more vehicles are in use simultaneously. On some facilities, as many as 20 students receive instruction at the same time under *one* teacher's direction.

Thus, the distinctive features of the true multiple-car method are: (a) more students than teachers are driving at the same time; and (b) students are instructed by a teacher positioned outside the vehicles. From an educational standpoint, the multiple-car method emphasizes *learning* rather than *teaching*. With the instructor outside the car, the student is freed from the pressure of close contact with the teacher and adjusts to the various driving situations himself. This tends to instill confidence and self-determination in the student.

Objectives of the Multiple-Car Method

The multiple-car method addresses itself to two broad categories of objectives: those that are involved with basic control (manipulation) and those that are involved with conflict avoidance.

Manipulative Objectives. Given a multiple-car driving facility the student will demonstrate basic control tasks by:

—Identifying car, driver, and roadway factors that may affect his vehicular control or maneuverability;
—Predicting car, driver, and roadway factors that will affect his vehicular control or maneuverability;
—Deciding the appropriate response to maintain vehicular control and maneuverability based on adequate identification and prediction; and
—Executing appropriate driver action to retain vehicular control and maneuverability.

Conflict Avoidance Objectives. Given a multiple-car facility designed to simulate critical situations student will:

—Identify those vehicles, pedestrians, objects or obstructions that he might have conflict with;
—Predict the possibility of conflict with vehicles, pedestrians, objects or obstructions;
—Decide the appropriate driver response to avoid or reduce these conflicts; and
—Execute appropriate driver actions to avoid or reduce conflict.

Advantages of the Multiple-Car Method

The controlled environment provided by a multiple-car facility has several instructional advantages. It does:

1. Help the student develop basic manipulative skills.
2. Help the student develop independence and confidence in his own ability.
3. Help the student develop a sense of responsibility.
4. Allow the teacher to recognize and teach toward individual student differences.
5. Help the student develop perceptual habits.
6. Provide flexibility, allowing for a wide variety of situations.
7. Allow the teacher to do a more efficient job of instruction.
8. Allow the student an opportunity to drive various makes and models of cars.

Controlling Hazards

Some educators have expressed concern over the possibility of the increased accident potential created by having students operating vehicles without an instructor in the car. With a multiple-car facility that is properly designed and managed, this concern is unfounded. Experience has proven that on a well-designed facility, and with a competent teacher in charge, accidents rarely occur.

A low or accident-free experience is not, of

course, achieved without proper controls. The best way to control accidents is to (a) properly orient students to the various activities so that they know what is expected of them; (b) design the facility so as to minimize accident producing situations; (c) provide a good communications system, and (d) utilize a competent, responsible, and properly prepared teacher.

Research Relating to the Multiple-Car Method

The potential of the multiple-car method has been indicated through several research studies.

Brazell (6), for example, investigated the driving performances of 2,785 male students a few years after they had completed driver education courses under one of three methods offered in the Dearborn, Michigan, school system. Using state driving records (which indicate moving violations and accidents) as criteria, Brazell found that off-street methods, including the multiple-car method, were as effective as the on-street method.

Another study, this one by Bishop (5), compared the effectiveness of on-street instruction with multiple-car. His study revealed that six hours of on-street instruction is not significantly superior to (a) six hours under multiple-car method; (b) six hours of multiple-car, plus one hour of on-street; or (c) six hours of multiple-car, plus two hours on-street.

Nolan (19), too, found little difference between the driving of high school students who had received 10 hours of multiple-car, plus two hours on-street instruction, and a comparable group who had received 10 hours of simulator and three hours on-street instruction.

Gustafson (12) compared the results of students taught under a combination method (driver simulator and multiple-car) with those taught solely under the multiple-car method. Additional on-street instruction was later added to both methods to see what effect this had.

In both instances, students taught exclusively on the multiple-car facility scored significantly better on driving-range skill tests* than those who had been instructed under the combination.

Recent research by Thomas Seals and Charles McDaniel indicate that instruction utilizing the driving simulator and multiple-car method compares favorably to on-street driving instruction only (23).

The American Institute of Research, under the auspices of the U. S. Department of Transportation, is conducting a study on the development of standards for driver training simulators, driving ranges and modified cars (10). The final report is due this year, but preliminary reports indicate that through the use of driving ranges individuals can be instructed more efficiently—therefore, producing better drivers —than those receiving on-road instruction only.

Not a Panacea

Multiple-car instruction offers a real opportunity to increase the efficiency and quality of driver education at a reduced cost. This is not to suggest that the multiple-car method is a panacea for all the problems involved in driver education. However, *properly used,* it can contribute significantly to an effective and economical driver education program.

Unfortunately, worthwhile teaching innovations are sometimes misused. Administrators and teachers looking for magic formulas and shortcuts to meet certain educational needs sometimes extend the use of a specific method far beyond its potential. Driver education is particularly susceptible to this treatment. When properly used, educational television, programmed learning, simulators, and the multiple-car method all can make distinctive contributions to the behavioral objectives of driver education. However, any method becomes inefficient when used as a means to an *inappropriate* end. Dr. Richard W. Bishop had this to say about the importance of determining what can be accomplished by a given method:

> Simulator and multiple-car driving methods are often substituted for part of the expensive on-street phase. In reality, those two methods are not identical. They are not even similar. To compare the two methods is somewhat like comparing apples and peaches. On second thought, a more appropriate analogy is to use apples and corn (fruit and vegetables). Both of these food products make distinctive contributions to our nutritional needs; therefore, one should not be substituted for the other. So it is with simulation and multiple-car methods. While they both contribute in varying degrees to the recognition, decision-making, and performance phases of the driving tasks, their strengths are not the same in my opinion. Simulators contribute distinctively to recognition and decision-making, while multiple-car instruction is especially strong in developing basic skills (a part of performance) and the art of communicating with other drivers. If this analysis is accurate, then the two methods should be used to complement each other rather than compete with each other. (5)

In other words, to properly use this method of instruction it is essential to adequately plan the multiple-car facility in relation to the total driver education program.

* That is, tests purporting to measure ability of students to maneuver vehicles on the multiple-car facility and in its various exercise areas.

Planning A Facility

Guiding Principles

Intelligent planning of a multiple-car facility requires a knowledge of driver education in general, and the multiple-car method in particular. This knowledge is essential if realistic, long-range objectives are to be developed from a sound basis. The following are typical questions which should be asked and answered during the initial planning stage.

What local, state, and national policies and regulations have a bearing on planning?

—Effect of the Highway Safety Act of 1966?

—On what basis does the state recognize or approve use of the multiple-car method?

Will instruction be made available to *all* eligible students?

—How many are eligible in the current year?

—Five years from now? Ten?

—How about adult and special programs?

Do you have support from the school, communities, and administrators?

—Community agencies?

—Auto dealers?

Which procedures best meet the objectives of the school's driver education program?

—Classroom, multiple-car, and on-street experience?

—Classroom, multiple-car, simulation, and on-street experience?

—What is the appropriate combination of the various phases?

What financial resources are available to support the program?

—Will Federal funds be appropriated?

—Can special state-aid be made available?

—How can initial construction costs be handled?

What local conditions prevail?
—Availability of land?
—Instructional personnel?
—General climate and weather conditions?

While these questions may seem formidable to the uninitiated, they needn't be. Schools providing any type of a driver education program have already addressed themselves to some of them. Some schools have considered all of them, and more, in initiating the multiple-car method. The point: Questions such as these should be raised, and answered, during the planning stage, not the development stage.

Although all of these questions are basic to the development of sound guiding objectives, none are more critical than those relating directly to the nature of the proposed instructional program. Two basic laboratory instructional treatments* are available to schools planning to use the multiple-car method:

1. Treatment MC-ST: Under this option laboratory experience is provided through the multiple-car method and through on-street driving experience.
2. Treatment SI-MC-ST: Under this option the laboratory experience consists of coordinated instruction provided through simulation, multiple-car method, and on-street driving experience.

Authorities feel that at least two hours of laboratory instruction be actual on-the-street driving. More than two hours on-the-street instruction will be required if the multiple-car facility size and design is limited.

Facility Size

Determining the type of instruction that is to be offered is the first question that must be answered when deciding on facility size and construction.

There are three fundamental types of instruction that can be offered on multiple-car driving facilities: basic skills, traffic mix, and advanced driver training. These types of instruction are based upon the IPDE objectives presented in the Introduction.

1. *Basic Skills Facilities:* A facility can be designed around a selection of basic skill exercises. Typically, this type of facility can be less than 200′ × 400′. On this facility, the student is allowed to practice parallel parking, garage exercises, etc., to the point that he has mastered the basic control and maneuverability with his vehicle.

* All assume provision for classroom instruction as well.

The basic skills facility is the most fundamental type. Many schools use a paved area that they can close to general use for this type of facility.

In this area, the teacher can set up traffic cones or stanchions to mark out exercise areas. One teacher can instruct several students in these basic skills. However, a multiple-car facility of this type will require that more than two hours of on-street instruction be provided.

2. *"Traffic Mix" Facilities:* A facility can be designed around the principles of "traffic mix." Here, certain design aspects of the basic skills facility are combined with traffic lanes to provide the student with experiences in intersections, merging, exiting, lane changes, passing, etc.

The minimum size for such a facility should be approximately 200′ × 400′. A good example of this type is the facility presently in use at Illinois State University in Normal, Illinois (see diagram).

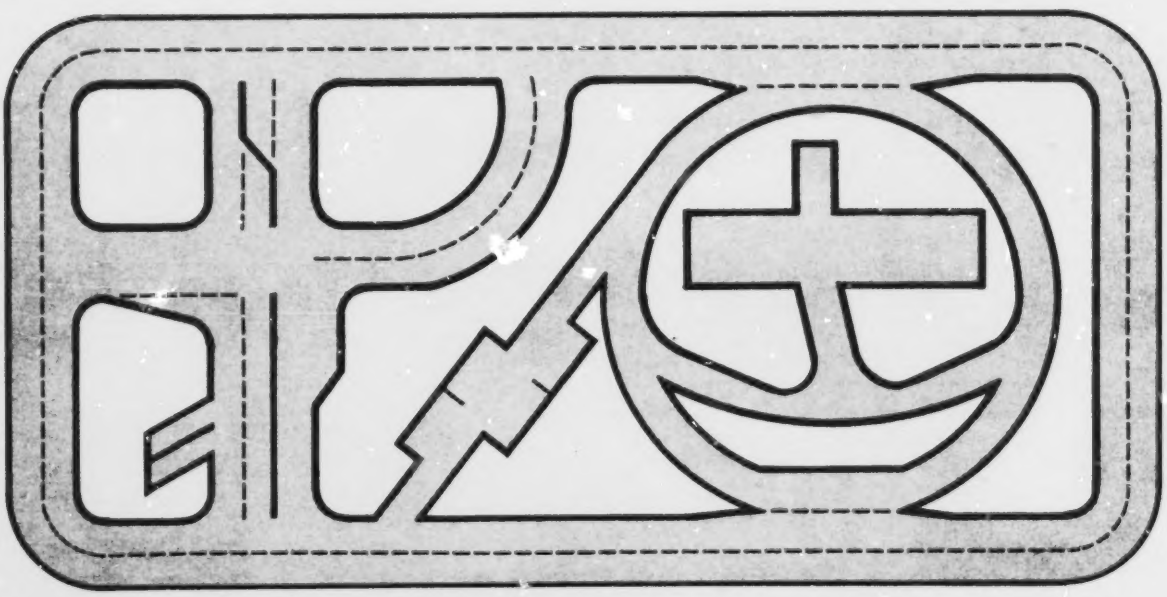
Early instruction here is devoted to the development of basic control and maneuverability of the vehicle. The final lessons are structured to emphasize traffic mix or interaction. In these lessons the student is all but on his own to drive into intersections, merging and exiting exercises, and the basic skill areas (i.e., parking, garage). At this time, the student who is progressing at an advanced rate will find himself exposed to and practicing the fundamental principles of IPDE in traffic mix situations, while the slow learner will have the opportunity to continue practicing basic skills. This range will also allow for the inclusion of advanced driving exercises on a limited basis.

Many facilities that were originally designed with heavy emphasis upon basic skills have revised their layouts to include more decision-producing traffic mix situations. Some early facilities (i.e., Michigan State University—see diagram) were traffic mix facilities.

3. *Advanced Driver Training Facilities:* Facilities can be designed to incorporate those experiences presented in facility types 1 and 2 and, in addition, advanced training exercises such as off-road recovery, blowout simulation, skidding, etc. A good example is the facility at the Safety Center at Central Missouri State College in Warrensburg, Missouri (see diagram).

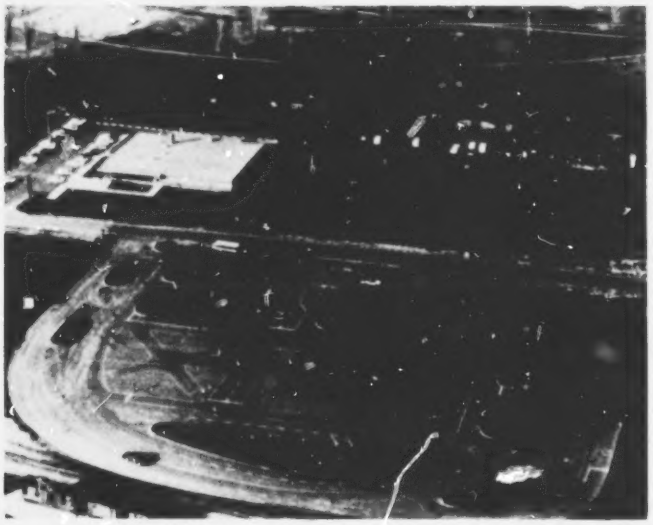
Allowable speeds here require that the facility itself be larger than 200′ × 400′. Blowouts can be simulated, potential accident situations can be simulated in a controlled environment, skid pan exercises can be incorporated, high speed off-road recoveries can be executed, as well as several other special experiences. Not only are automobiles used,

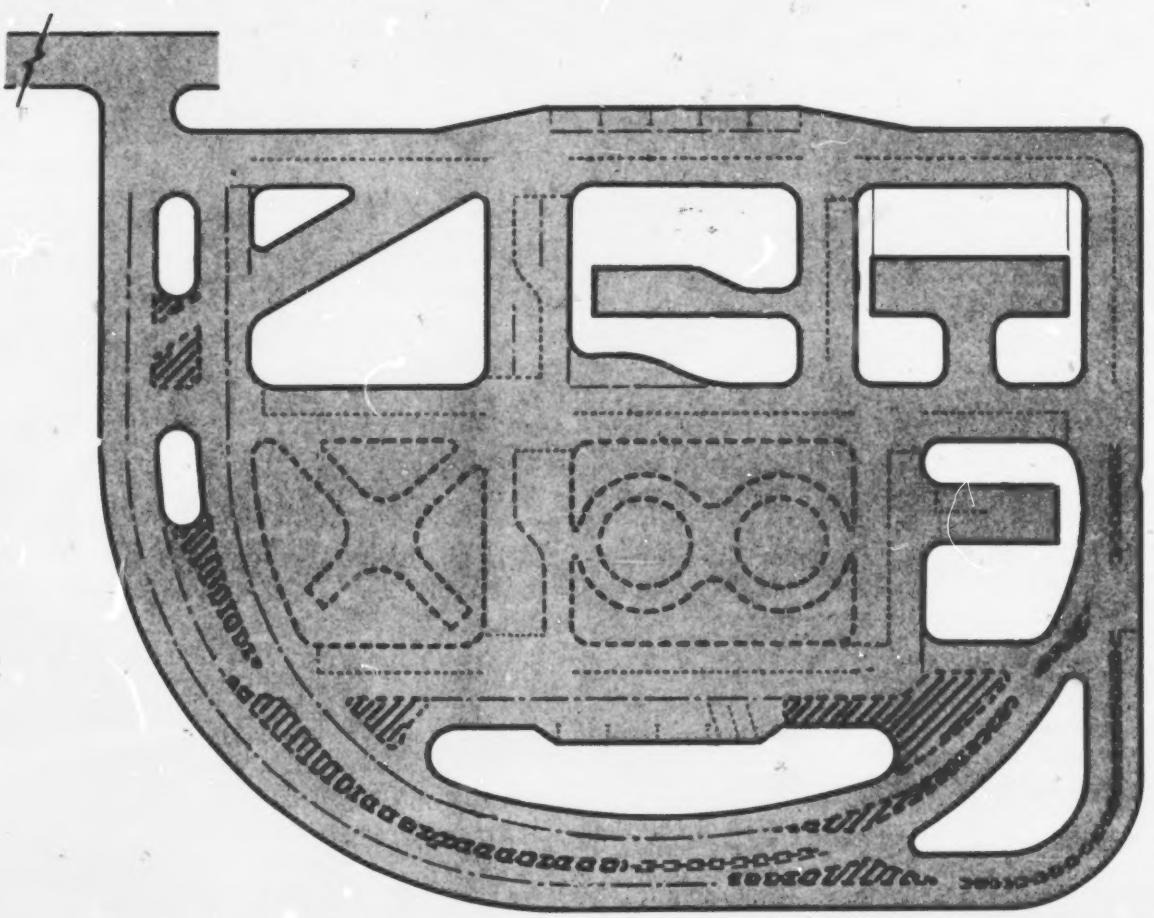
ILLINOIS STATE UNIVERSITY
MULTIPLE-CAR FACILITY
NORMAL, ILLINOIS



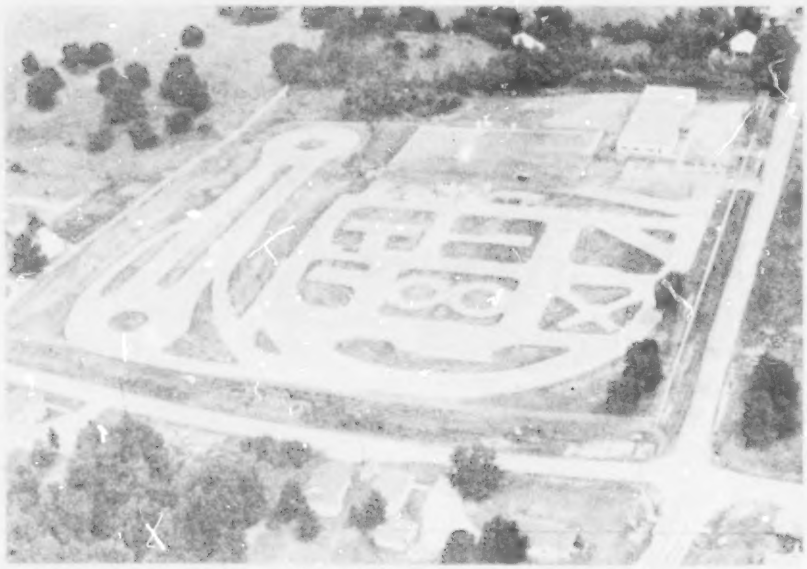
Fundamental Dimensions (Minimum)
4" Line Width
18" R for Intersections
12' R for All Other Corners
12' Lanes

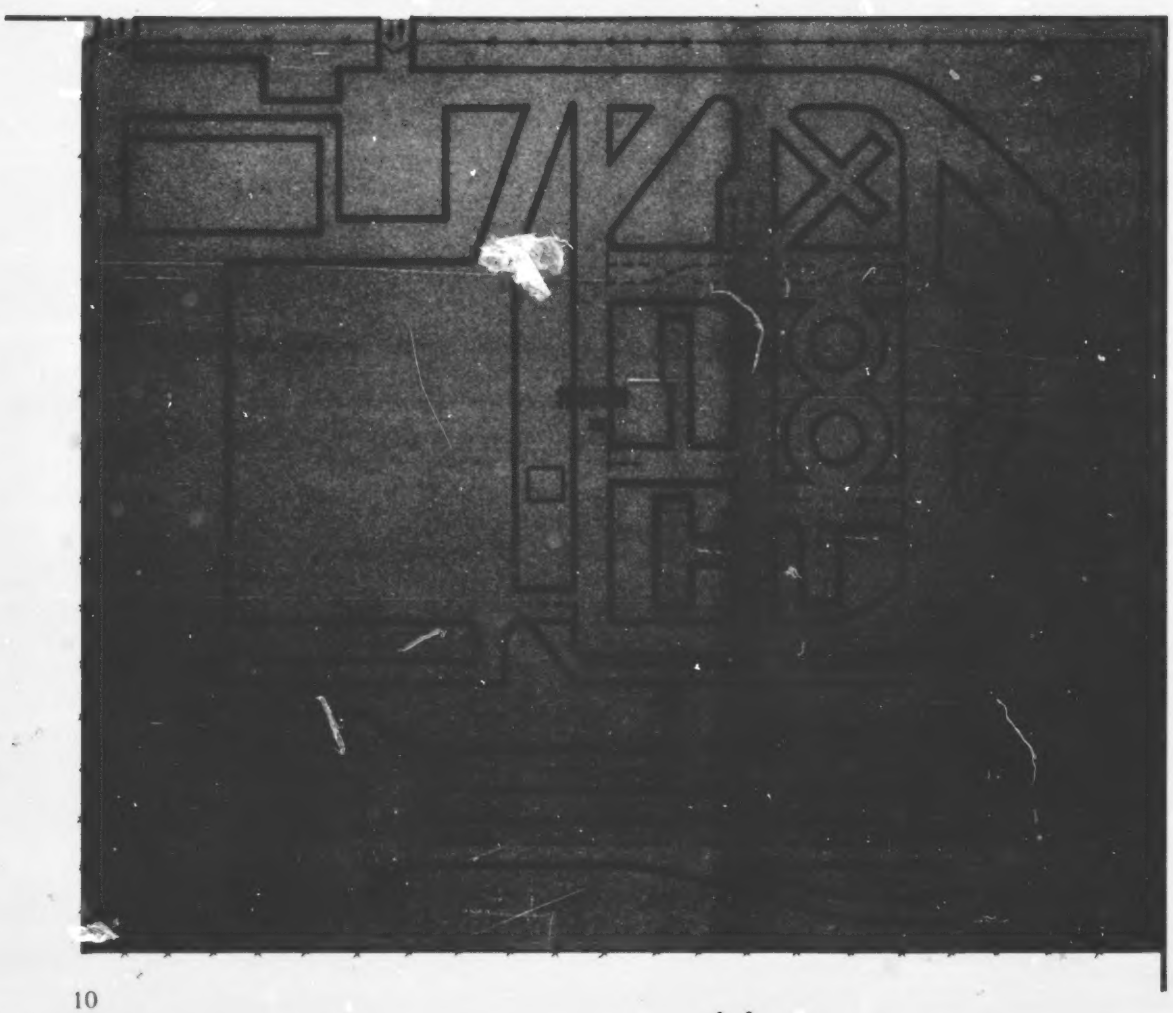
MICHIGAN STATE UNIVERSITY
MULTIPLE-CAR FACILITY
EAST LANSING, MICHIGAN





CENTRAL MISSOURI STATE COLLEGE
MULTIPLE-CAR FACILITY
WARRENSBURG, MISSOURI





but special programs for police, school bus drivers, truck drivers and others can be provided. If a facility of this nature is desired, *special counsel* should be sought from state traffic safety centers, supervisors of driver and traffic safety education, or other qualified agencies such as the driver education research staff at the General Motors Proving Grounds in Milford, Michigan.

There are some special aspects that must be considered when selecting the type of multiple-car driving facility that will work best in any given situation.

If the school is already using simulation, then the basic skills facility may be the best selection. If the facility is going to be the only supplement to on-the-street instruction, then the traffic mix facility, with its emphasis on the human functions of driving (IPDE), will be the best selection.

The local system may decide to incorporate those aspects of the advanced driver training facility. In that case, more extensive planning will be required. Planning should also assure sufficient traffic mix (i.e., more than six vehicles are needed to permit realistic traffic mix).

Special note should be given to state rules and regulations at this point. In most states, two hours of range experience can be substituted for one hour of on-street experience. This substitution can be used *for up to* four hours of on-road experience. This is *not* to imply that eight hours of experience on the basic skills range can be realistically substituted for four hours of on-street experience. The amount of time that can be effectively substituted will have to be determined on an individual facility basis.

The preceding diagrams are representative of multiple-car facilities currently in operation throughout the country. It should be emphasized here that since multiple-car facilities are of differing sizes and shapes, planners must clearly identify their basic instructional goals, explore the various alternatives available, and *then* plan the size and design of a facility that best meets the objectives of the total program.

Cost Considerations

The development of a multiple-car facility will entail three major expenditures: land acquisition, construction, and operating costs.

In many instances the cost of land represents a substantial initial expenditure, especially where purchase of urban land is required. To help overcome this problem, some schools have pro-rated land and construction costs over a period of years.

In some communities funds may be more easily secured if a *dual* purpose facility is planned. Some schools provide driving instruction during the day and convert the facility to a parking lot for evening activities.

A facility planned in connection with a new building or campus might be included in a bond issue authorization. An outlay of several thousands of dollars for driver instruction represents a good community investment in terms of its potential for reduced injuries, deaths, and economic losses arising from traffic accidents.

Some schools have discovered that an existing paved area of sufficient size can be readily adapted to use as a multiple-car facility. The use of such an existing area can eliminate the high cost of land acquisition, grading, and surfacing needed for a specially designed area.

More than half the states in the nation have special state-aid plans to assist local schools in financing driver education programs. Generally, such plans provide for reimbursing local schools with a certain percentage of their per-pupil cost for each student completing the course. In some instances special provisions are made for the authorization of construction costs and/or the purchase of equipment.

Where special state-aid financing exists, a laboratory approach like the multiple-car method offers an opportunity for "recovering" capital investment, since teacher productivity is markedly increased. The local school district incurs the necessary expenses to build or develop a facility, pro-rates the cost over a period of years, and is reimbursed through special state-aid funding.

Federal assistance has been made available for planning and financing multiple-car facilities. Under the Highway Safety Acts of 1966 and 1970, funds are available for research, development, and improvement in driver education. This alternative should be explored when planning a multiple-car facility.

Beyond tax dollars, or in addition to them, lies the potential of local business and industry support, professional and service club interest, and donations from individual citizens or the public at large. Such support can take many forms—among them financial contributions, and donations of land, labor and materials. Obviously, such potential is more easily and quickly realized where the school has long maintained a good driver education program and the community is well informed of this fact.

Among the most important factors affecting the economical use of a multiple-car facility, student enrollment is paramount. If the enrollment figure is high, the per-pupil cost will be reduced propor-

tionately. If student enrollment is low, the cost will not be reduced significantly.

This makes it doubly important to determine during the planning stages how the facility will be used. If student enrollment is low, every consideration should be given not only to getting maximum use out of the facility during regular school hours, but to converting the facility to other uses during non-instruction periods.

There is, of course, no precise enrollment figure which *all* schools can employ to justify the use of a multiple-car facility. It has been found, however, that where the initial investment is moderate and dual-use can be made of the facility, as few as 250 students will justify the use of the multiple-car method on a cost basis alone. Where the capital investment is large, the annual enrollment potential must be above 250 if economical operation is to result.

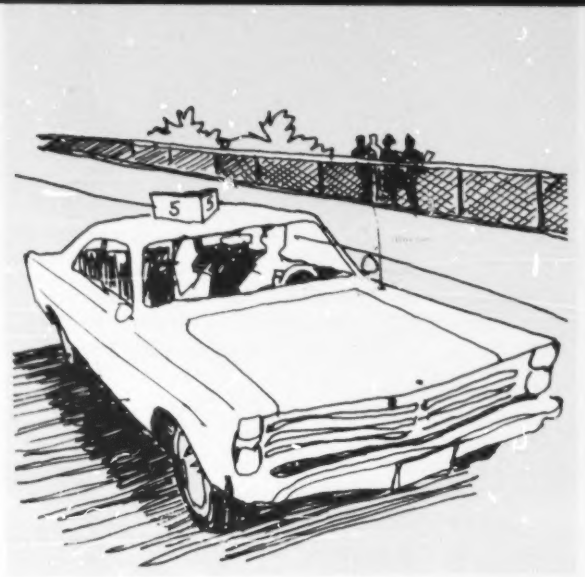
Site Selection and Development

Whenever possible, the facility should be located near the school; otherwise, serious problems arise with respect to transporting students, and maintaining driver education cars. However, the facility should not be so close to the school as to distract indoor classroom activities. If a radio communications system is employed, no appreciable auditory distraction is likely to result. But if communication is by voice or loudspeaker, distraction may result.

In selecting a site, soil composition and drainage should be considered. Excess water can be handled by sloping roadways or through the use of storm sewer drainage outlets. This sloping should not consist of a hill designed into the middle of the facility which does not allow for a clear view from one side of the area to another. Where snow is common, provisions should be made for ease of snow removal and disposal.

In most instances, some type of building or enclosure will be needed for the storage of such equipment as traffic cones, stanchions, and radio equipment. Also to be considered are toilet facilities and telephones, especially when the proposed training area is to be beyond the immediate vicinity of the school building.

Safety is another factor to be considered in site selection, especially if a parking lot or similar area is to be converted into a multiple-car facility. The entire facility should either be enclosed by a fence, or surrounded by a "buffer" area kept free of pedestrians, buildings, or other obstacles. If fencing is used, it should be set back at least 12 feet (preferably



more) from the outer edge of roadway or exercise area used by students. This allows for clearance of the front and rear "overhang" of cars whose wheels remain on the roadway, permits sufficient clearance for the "swing out" of turning vehicles, and affords a modest space for recovery should vehicle wheels drop off the roadway's outer edge.

Lighting the facility should be considered both for security purposes at night and to permit evening classes to be scheduled. If gasoline pumps are installed, and if cars are to be stored on the facility, fencing around this storage area will improve security efforts.

Facility Design

Thus far, no exact method has been found to measure the influence of a facility's size and design on the quality of instruction. But, it appears that the larger the facility, the greater the opportunity for traffic mix. This does no mean that smaller facilities are ineffective, but rather that the limitations on the development of perceptual skills on some facilities have to be compensated through other means.

As explained previously, multiple-car facilities can be of a variety of sizes and designs. But regardless of the size and design selected, three factors should always be taken into account: the facility should (1) afford visual contact for the instructor from any one point to all other points; (2) have sufficient learning activities to accomplish the desired objectives of a particular multiple-car facility design; and (3) be designed so that sufficient learning activities are available to all students throughout the course of instruction.

During the blueprint design stage, the services of a local architect or highway traffic engineer might be used. Assistance should also be obtained from

college and university staff as well as consultants from the State Department of Education. In any case, the driver education staff should serve in a continuing advisory capacity.

The specific functions the facility is to serve dictate its internal design features and exercise areas (also see Appendix A). The following should be considered in planning:

1. Standard road markings should be used to define right and left turn lanes, merging and diverging traffic.
2. Standard highway signs either permanently mounted on posts, portable, or both.
3. A standard operational traffic light is recommended but not essential.
4. A perimeter road with two 12-foot lanes. Some portions of this road should have three-lane sections or should be designed as a divided highway with a median strip.
5. Cross roads designed to include one major four-way intersection and one or more *T* intersections. At one *T* intersection the approach should preferably be marked for two lanes of traffic entering the *T*, and one lane in the other direction.
6. A raised or "hill" section, preferably at one outside corner of the facility for practice in hill driving, starting, stopping, and parking. A five percent grade has been used successfully.
7. A straight section of road long enough to practice the fundamental steps in safe overtaking and passing.
8. An area for the "T Exercise" for practice in forward and reverse driving between two points.
9. A "Figure 8 Exercise" area to enable practice in steering.
10. An area for "X Exercise" for practice in forward and reverse driving and turning.
11. An area or street for practicing the "Y" turn (or turning around on a deadend street).
12. An area for entering and leaving a simulated two-car garage with a single-lane driveway intersecting at the street (or a similar offset practice area).
13. An area or areas that can be designated as a one-way street.
14. Provision for parallel and angle parking, on both the right and left side of a street and, if possible, in both an offset area and adjacent to a lane of regular travel.
15. Others as appropriate (e.g., pedestrian crosswalks, simulated railroad crossing).
16. An area suitable for advanced driving techniques including skid pan.
17. An area for merge and exit techniques.

NOTE: The number of vehicles to be used on a facility will dictate the number of exercise areas to incorporate and configuration of traffic mix points (i.e., intersections).

Experience has shown that the entire facility should be paved with asphalt or concrete. Portable curbing can be used to delineate parallel, angle, perpendicular, and up and down hill parking areas. If portable curbing is used, it will not interfere seriously with off-hour parking for athletic contests or evening programs. This type of curbing is also usually less expensive than a regular full curb.

Some school systems use pre-cast portable curb sections which can be removed when the area is used for parking. Portable curbing can also alleviate the snow removal problem.

Once a facility is completed its maintenance requirements will be centered around such needs as repainting lane and roadway markings, and minor repair and replacement of traffic signs, cones, stanchions, and other equipment. Much of this work can be handled by school maintenance personnel. Of course, after several years of use, particularly in severe weather areas, some roadway maintenance will be necessary. Even in these instances, a good asphalt or concrete surface should provide many years of maintenance-free services.

Equipment

A facility requires: vehicles, fixed installations, and portable equipment.

Vehicles—Schools generally secure free-loan driver education cars through cooperative programs sponsored by local car dealers and automobile manufacturers. Under these arrangements schools usually assume responsibility for insurance, regular maintenance, general car care, registration, and dual controls. Some schools prefer to lease or purchase their vehicles.

Before securing driver education cars, a realistic assessment should be made of the number of vehicles needed. Such an assessment should be based on enrollment demands and scheduling needs.

It is recommended that all of the cars used on the facility be equipped with dual controls. This allows each car to also be used for on-the-street instruction, which aids in eliminating some of the

maintenance problems resulting from the slow-speed operation. When a "reserve" car is available, vehicles can be serviced and maintained on a regularly scheduled basis, thus avoiding serious disruption of classes resulting from out of service cars. A small truck or van can serve both as a specialized training vehicle and as a service vehicle for range equipment.

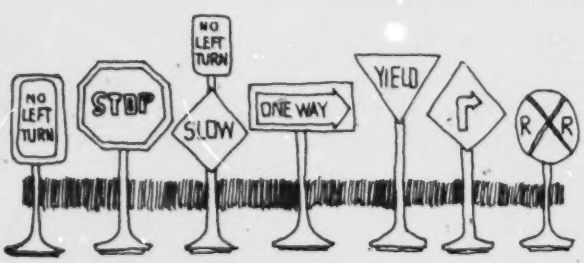
The automatic transmission car has been a boon to multiple-car method instruction. The learning process is accelerated and safety considerations are enhanced with this type of vehicle. In most multiple-car programs it has been found advantageous to employ a fleet of cars that includes one manual transmission vehicle and the remainder with automatic transmissions. This allows the instructor to schedule at least one lesson in the manual shift car for all students or for those specifically requesting this experience. Where more than one vehicle on the facility is equipped with a manual transmission, special planning is required to cope adequately with a more complex teaching-learning situation.

Many schools prefer to use a variety of automobiles, rather than a fleet of the same make. This exposes the students to different makes and models, widens their experience and stimulates flexibility and adaptability.

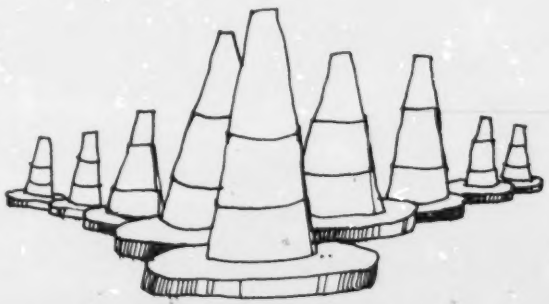
Fixed Installations—The feasibility of fixed equipment may be questionable if maximum flexibility of the facility is to be obtained. However, fixed equipment that may be considered includes: posts or standards for mounting signs; a storage enclosure; and traffic signs. The size, color and shape of traffic signs should conform to highway standards embodied in the *Manual on Uniform Traffic Control Devices for Streets and Highways* (8). The installation of the signs should, when possible, be made according to highway engineering specifications. Limited space on the facility may force some modifications to assure proper visibility and safety for drivers.

Portable Equipment—Portable equipment can increase the maximum flexibility of the multiple-car area. The following list is neither inclusive nor absolute, since certain items may serve a limited purpose on some facilities. The list includes:

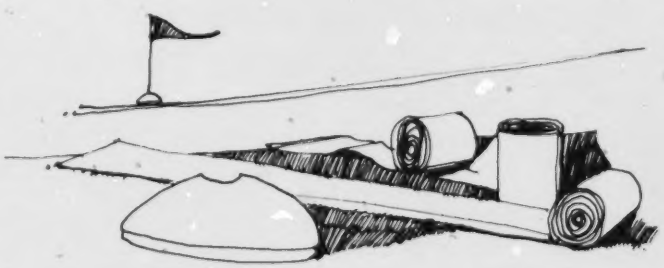
1. *Portable traffic signs.* These are similar to regular, permanently located traffic signs, but offer an advantage in that they can be moved to change traffic patterns. Various mountings are possible. Because of occasional high winds, sign mountings will often need to be either placed close to the road surface or anchored in a wide heavy base.



2. *Traffic cones.* Rubberized or vinyl traffic cones are available in many sizes and colors. Traffic cones are useful for delineating exercise areas or lanes, serving as partial barricades, and aiding students in learning distance judgment. In some instances flag markers on poles may be used with traffic cones.

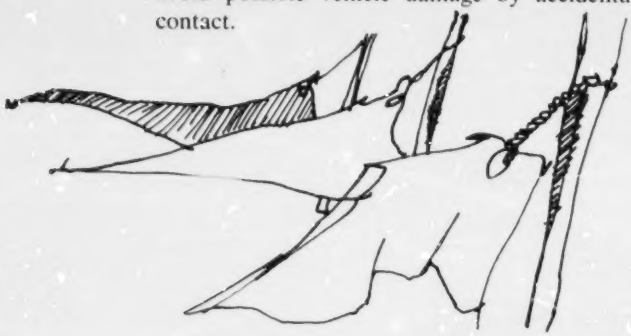


3. *Lane markings.* In addition to traffic cones, other temporary lane markings include: the "roll down" tape, and the "button marker." The "button marker," which is used to hold a pole and flag, is available in several forms. One type has been made of concrete by school personnel; more recently rubber bases have been available on the market. Rubber automobile tires also can be used as curb markers, but these tend to be unsightly and easily bumped out of place unless fastened to the ground.

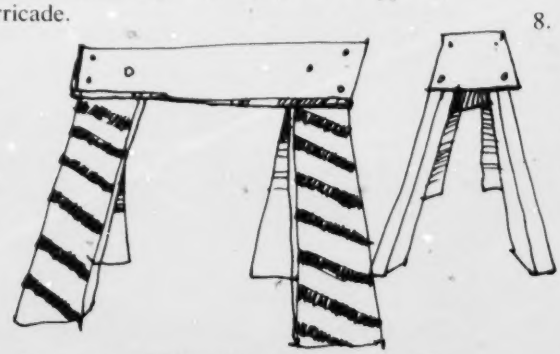


4. *Flags and poles.* Triangular shaped flags are best, since they present less surface to the wind than do square or rectangular shapes. Flags of at least two different colors (viz., red, yellow) allow different meanings to be designated (e.g., guide vs. regulatory) for different areas

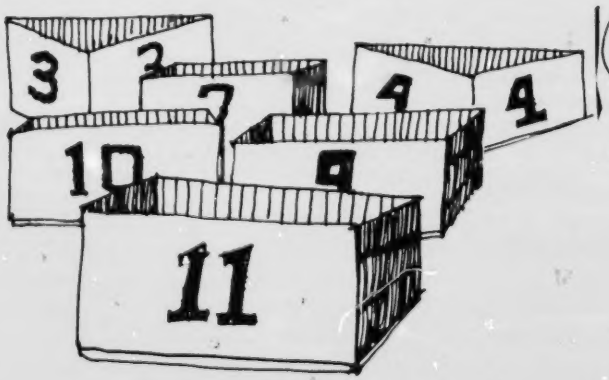
or maneuvers. Where possible, poles should be of a flexible rubber or "spring-back" type rather than of rigid breakable material, perhaps placed in traffic cones or "button markers" to avoid possible vehicle damage by accidental contact.



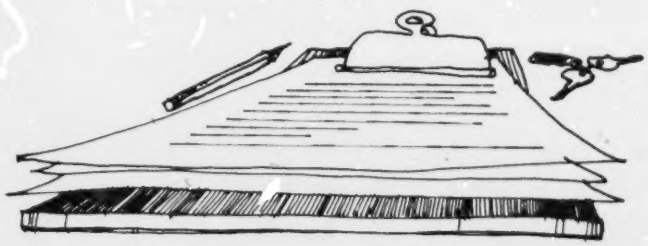
5. *Barricades.* At certain times and for certain maneuvers it will be necessary to barricade roadways, exercise areas and entry roads to the facility. Wooden "sawhorses" can be used for this purpose, as can wooden stanchions and traffic cones. Wooden stanchions, of course, are highly vulnerable to damage, and should be placed where they will have minimum contact with vehicles. Movable concrete curb sections may also serve as a type of barricade.



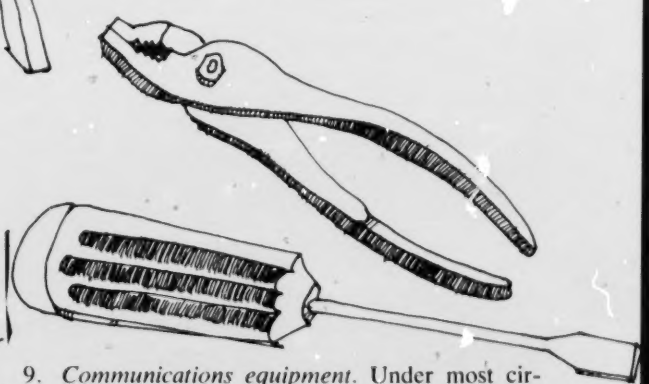
6. *Car equipment.* This category includes such items as decals, bumper signs, car number signs, and dual controls. Three- or four-sided rooftop signs may be mounted on rooftop racks or held in place with suction cups, tape-covered magnets, or a roof strap and clamps. Regardless of the method used, each car should be clearly marked in the driver's compartment with the same number shown on its exterior.



7. *Instructor aids.* The instructor's equipment should include such essentials as foul-weather gear, lesson plans, rating sheets, a clipboard, and hand-out materials. Ignition keys should be kept on a keyboard marked by car number, model and other pertinent information. An extra set of keys should be kept readily accessible.

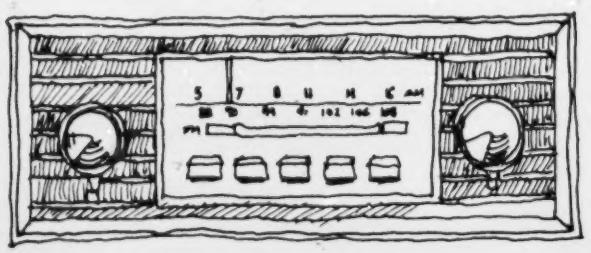


8. *Maintenance equipment.* Local conditions and arrangements dictate the needs in this area, but some simple tools (crescent wrench, screwdriver, pliers, battery jumper, etc.) and cleaning equipment (brooms, clean cloths, etc.) is advised.



9. *Communications equipment.* Under most circumstances, radio offers the most practical form of communication on a multiple-car facility. Other options include direct voice communication or the use of a loudspeaker system. The former is difficult because of distances involved, wind, and inclement weather. A portable loudspeaker system requires the in-

structor to carry the equipment, is often disruptive to others in the area, and is also subject to the problems of wind and inclement weather.



One radio system available consists of an FM transmitter for the instructor and an AM or FM receiver for each vehicle. Such transmitter units are sold by several manufacturers, and are available through most radio or electronics stores. Some models are small, light weight, and equipped with built-in pinhead microphone, plug-in antenna, and on-off switch. Most transmitters operate on small 8.4 volt batteries. Units of this type have been used effectively on facilities where transmitting distances ranged up to 400 feet or more.

The Federal Communications Commission has made the frequency band 88-108 megahertz available for one-way communications. Where cars are equipped with FM radios, the only adjustment needed is to tune the transmitter and the FM radio receivers at approximately 90 megahertz.

A car equipped with a standard AM radio can be readily converted into a citizens band receiver. This can be accomplished by modifying the AM radio with a CB converter. The converter enables use in the manner described for the FM radio receiver.

Other radio communication systems include citizen-band receivers operating on the car antenna and power supply, or "walkie-talkie" radios mounted in each car. In most instances, these systems fail to achieve the reliability, flexibility, and economy possible with the systems described above, either the FM transmitter-receiver or the FM transmitter-AM citizens band converter receiver.

Many communication systems are being introduced annually. A complete evaluation based on local conditions is advised before selecting a particular radio communication system.

Planning And Implementing Instruction

An Instructional Plan

As noted earlier, instructional methods, facility size and design will vary from one school to the next. Because of this, no firm and fast instructional plan can be developed that will apply in all cases. Nevertheless, those planning a multiple-car program should be familiar with research data, professional recommendations, state regulations, and local conditions bearing on such a program. When these are known, many of the following suggestions may be applied or adapted to a particular school setting.

One instructional plan used effectively in many schools is described below (11). Variations of this plan, or somewhat different approaches, are possible. A new teacher can use this plan at first, modifying techniques as he acquires additional experience and gains new insights.

For the initial experience on the range, the cars are lined up side-by-side at least six to eight feet apart. Following a briefing of the lesson plan for the day, students go to their assigned vehicle and wait with key in hand for further instruction. The teacher then directs the students to enter their cars and execute preparatory steps such as adjusting seats and mirrors, checking doors and windows, and checking the brakes. For efficient use of range time, students should be familiar with these steps beforehand through reading assignments, class discussions, and simulation experience. When preliminary steps have been completed, the teacher "talks through" the steps for starting the engine as the students execute them. The students then repeat this phase of the lesson a few times on their own.

Now the students are ready to learn how to drive the car forward . . . and stop smoothly. The teacher guides students through the steps of moving the car forward and stopping. After each student has driven his car forward about 50 to 75 feet (depending on space available) so that all cars are again in line,

the teacher directs the students to move forward again all at the same time. During this phase of instruction the teacher is watching the drivers closely in order to spot those who are having difficulty and those progressing satisfactorily.

Students are directed to drive around the range in a counter-clockwise direction at a slow speed, with an interval of at least three to five car lengths between cars. The teacher stations himself near the most difficult turn so that he can "nip in the bud" potentially dangerous situations. After 10 to 15 minutes of this practice, the pattern of traffic should be reversed to a clockwise direction.

After the first lesson, at least one new maneuver is introduced each period. If the streets are wide enough (12-foot lanes), the group is divided from the second lesson with one-half the cars going clockwise and the other half going counter-clockwise. After 10 to 12 minutes they reverse directions so that students get equal time making right and left turns. Halfway through the second period another maneuver is introduced. Entrance into and exit from multiple lanes and lane changing are appropriate early experiences if facilities permit.

As pupils master successive instructional steps, they progress to more complex traffic mix situations requiring higher degrees of proficiency in the identification, prediction, decision, and execution abilities. Moreover, as they move about the facility, students devote extra time to practicing those exercises which prove most difficult, as may suit their individual needs. The exact nature and sequence of maneuvers practiced on the facility depends upon the size and layout, plus the teacher's imagination and ingenuity. In any event, new maneuvers and traffic patterns are introduced rapidly enough to challenge advanced students.

Appendix D describes exercise procedures for seven practice situations.

Special Education

Multiple-car facilities are an excellent aid in the preparation and training of educable mentally retarded and physically disabled students.

Experience has shown that most of these students are capable of operating a motor vehicle when instruction is directed toward their particular needs. The multiple-car facility lends itself to satisfying the particular differences and characteristics of students in this group. When extended time and proper equipment are provided and special education teachers are encouraged to participate, this facility can make a great contribution toward helping these students attain the abilities necessary for entry into the highway transportation system.

Sequence of Experiences

The following 10-lesson outline is offered as a sample time allocation plan (21). This outline assumes 10 instructional "hours" (i.e., actual class time of not less than 50 or more than 60 minutes per session).

As described in the foregoing instructional plan, the first few lessons tend to be of a different character from subsequent lessons. That is, in the initial lessons true *group* instruction and practice occur as the instructor "talks" students through step-by-step procedures on voice command. Beginning with the second lesson, at least one *new* exercise or maneuver is introduced each time the class meets.

As each new exercise is demonstrated, that exercise area is then made available to the student for practice. Students unable to perform a maneuver or exercise on the same day it is introduced and demonstrated will practice on a subsequent day.

After the first few lessons students are generally free to enter and leave streets and exercise areas at will, and to practice and improve their abilities in the situations available. It can be seen, therefore, that emphasis on *group* instruction is greatest in the initial lessons and changes more toward a combination of group and individual instruction in later lessons. Eventually, all students are evaluated on all phases of driving presented on the facility.

The sequence outlined on the following page, although it may vary somewhat after the second or third lesson, generally follows a progression from simple exercises to more difficult traffic mix situations. Differences in teacher viewpoint and facility design may also dictate other variations from this pattern.

LESSON 1
- A. Pre-Start
- B. Start
- C. Movement Forward
- D. Stop
- E. Left Turns

LESSON 2
- A. Review Range Lesson #1
- B. Right Turns

LESSON 3
- A. Review Range Lessons #1 and #2
- B. Two-Way Traffic
- C. Intersection

LESSON 4
- A. Offset Turns
- B. Lane Change
- C. Use of Exercise Areas for Backing
- D. Turning

LESSON 5
- A. Backing
- B. Turning Into Intersections and Exercise Areas

LESSON 6
- A. Parallel Parking
- B. Angle Parking
- C. Parking on an Upgrade With a Curb
- D. Parking on a Downgrade With a Curb

LESSON 7
- A. Continue Range #6
- B. Add Expressway Merge and Diverge Maneuvers

LESSON 8
- A. Continue Range #7
- B. Introduce Passing
- C. Introduce Run-Off Road

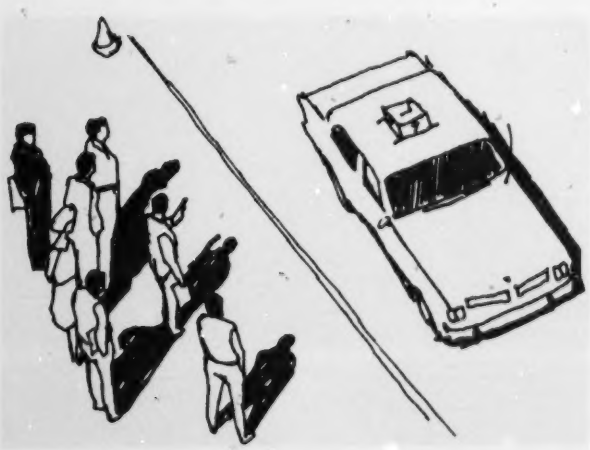
LESSON 9
- A. Serpentine
- B. Evasive Tactics

LESSON 10
- A. Skid Exercises
- B. Dry and Wet
- C. Complete Range #9

Preparing Students for Instruction

Students should be introduced to the multiple-car instructional method through:

1. Printed materials made available for study prior to the first day on the facility (see Appendix G and H).
2. Visual presentations in the classroom both before and after initial experience on the facility.
3. Demonstrations on the facility itself.



Printed Materials: These should include: (a) a set of regulations for student behavior and car operation on the facility; (b) instruction sheets or driving guides for each activity, similar to those typically used in the on-street program; and (c) a diagram of the facility and its exercise areas. Copies of all these items should be distributed to students well in advance of actual laboratory experience, so that they can be thoroughly studied and reviewed. Questions concerning these materials—especially those involving driving regulations—should be actively encouraged.

Visual Presentations: These include such items as chalkboard drawings, printed diagrams, facility models, overhead transparencies, slides, films, or video tapes. Presentations should initially provide a general orientation to the facility and its various streets, roadway markings, signs and signals, special regulations, and exercise areas. Experience indicates that when classroom visual presentations are performed in a realistic manner, laboratory instruction is enhanced. Five minutes in the classroom can replace considerably more time on the facility for routine and elementary instructions.

Demonstrations on the Facility: When preceded by adequate classroom instruction, demonstrations on the facility can be short and to the point. They can

be made either by the teacher or by a student selected and briefed in advance. In the latter case, students are grouped near the instructor to observe the specific activity or maneuver being demonstrated.

Inclement weather may force modifications, such as grouping students in nearby cars. In this case, the classroom visual presentations are all the more important.

Rationales are essential. The student needs to know *what* he is expected to do, *how* he can accomplish it, and *why* it is important to gain proficiency in the task at hand. The *why* factor is particularly important with respect to the use of specific exercise areas and situations since the students will not always understand their significance. For full understanding, teachers must explain the relationship between the learning activities on the multiple-car facility and "real world" driving on the street.

Scheduling

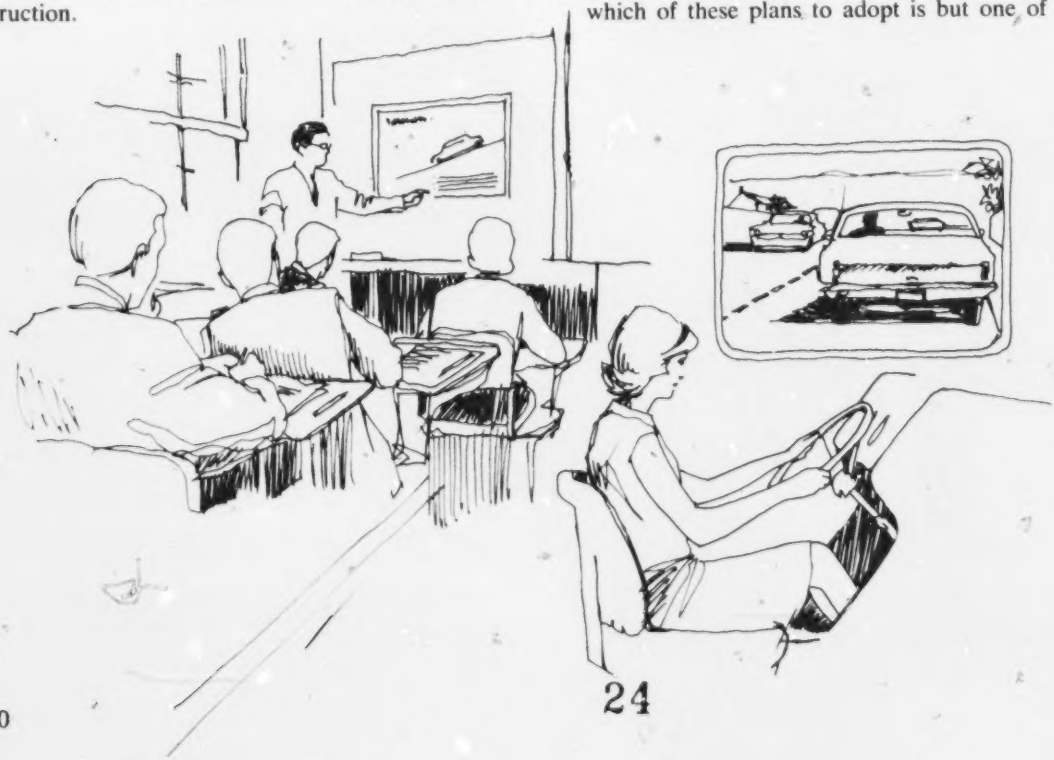
The complexities of scheduling students for instruction are familiar to driver educators and school administrators alike. In some respects, scheduling for multiple-car instruction is less difficult than for on-street instruction. The reason is, generally, *more* students can be scheduled for each time period available.

Despite this potential advantage, scheduling remains a problem requiring serious attention and creative thinking. It is particularly important to plan toward *concurrent* classroom and laboratory instruction.

It is also important to strike a reasonable balance between the critically abbreviated and the overly extended total instructional time spans that are possible. The former may take shape as a two-week cram session while the latter may see the course spread over an entire school year with much time elapsing between class sessions. As scheduling practices approach either of these extremes, the problems involved in student understanding and retention tend to increase.

Driver educators experienced in the traditional classroom and on-street instructional programs are fully aware of the essential importance of properly integrating these two elements into a meaningful total program. When a program is expanded to include simulation and/or multiple-car instruction, the need for close coordination and integration of instruction remains every bit as essential, while the challenge of meeting this need becomes more difficult. Careful instructional planning, competent administration and supervision, and periodic and systematic evaluation are needed to assure a high quality instructional program.

Numerous patterns for laboratory scheduling are possible. One plan calls for all instruction of one type (e.g., multiple-car or simulator) to be completed before the student begins a subsequent type such as on-street instruction. A second plan schedules students so that they alternate the time spent under one instructional method (e.g., multiple-car) with that of another type (e.g., on-street). Determining which of these plans to adopt is but one of the de-



cisions to be made in scheduling. An example of the second plan is presented in Appendix I.

Another major consideration is determining how much of the student's time is to be allocated for *each* type of laboratory instruction.* For example, the following timetable might be used for a "four-phase program" which efficiently draws upon the strengths of each method employed:

—8 to 10 hours of simulator experience;
—4 to 6 hours of multiple-car experience;
—2 or more hours of on-street experience.

In a multi-phase program (i.e., classroom, multiple-car and on-street instruction) laboratory time might be adjusted to a different apportionment. In reaching a final decision regarding minimum equivalency standards for apportioning a student's time, research data, professional recommendations, and state requirements must be considered. It should be remembered that because smaller facilities afford less opportunity to develop certain driving proficiencies, as few as four hours of multiple-car method instruction may represent the *maximum amount of time that can be justified in some instances.* In these situations a heavier apportionment of time will be required for simulation and on-street laboratory instruction.

But regardless of the facility size, or the amount of multiple-car and simulator instruction offered, *some* formal on-street instruction should be included in the driver education program (17). To complement student experience gained under the multiple-car method, on-street instruction should present driving situations not found on the facility. Such experience includes driving on rural roads, freeways, and congested city streets. If possible, the student should encounter hills, curves, pedestrians, and passing situations. In this way learners receive formal instruction and supervised practice in most aspects of driving.

Although the multiple-car method can unquestionably aid in the development of driving proficiency, a few obvious limitations exist. For example, because students do not generally experience speeds above 20 miles per hour, they miss supervised practice at open highway speeds. Furthermore, they do not experience *normal* traffic conditions. True, they interact in some ways with other vehicles, perhaps as many as 12 in a relatively small area, but the situation is carefully regulated with a homogeneous group of drivers. These limitations are the basis for recommending that students experience some supervised on-street instruction at highway speeds and in normal city traffic.

* Of course, the mount of time scheduled for *classroom* instruction is also important and has a bearing on the nature and extent of laboratory instruction to be provided.

Facilitating Instruction

Teacher Considerations: Assigning an instructor to teach a single method *only* is questionable. If he is isolated, he has little opportunity to understand what is taking place in the other methods of instruction or the total driver education program. When a multiple-car teacher is not required to teach on-the-street, he is seldom able to adjust his multiple-car instruction to the needs of the total program.

Teacher Location: As a general rule the teacher should be physically positioned on the driving area so that he can observe the entire facility at any given time, and can move freely and quickly to any place where he might be needed.

When a student with a special problem is identified, the teacher should attempt to assist the student from outside the car. Otherwise, the time spent inside one vehicle may restrict the instructor's ability to observe and communicate with other students. Determining when a teacher should ride in a vehicle, and for how long, can best be decided by the teacher in charge, after an evaluation of an ever-changing situation. In the first few lessons it is usually best that the teacher remain outside the vehicle and move from one location to another.

Maintaining Equipment: When the multiple-car facility is separated from the garaging or storage area, consideration must be given to the movement of vehicles. The movement of several cars can be time consuming. And, there can be servicing problems, particularly if certain vehicles are designated for facility use only (i.e., not used in the on-street instructional program). Because of slow operating speeds, these vehicles tend to require more frequent maintenance.

Maintaining the facility, painting, sweeping and snow removal, setting up and dismantling signs and other preparations needed to facilitate instruction must be allowed for, both before and after the regular instructional day. This is not to suggest that the teacher should perform all of these functions. His contribution as a professional is too valuable to have his time dissipated by an abundance of non-teaching tasks. The teacher or supervisor should, however, have both the responsibility and the authority to arrange for proper care and maintenance of the facility and the equipment.

Teaching Techniques: Teachers experienced in the multiple-car method employ a number of techniques

to facilitate learning and guard against accidents. These include:

1. Use of simple, direct commands based on key words.
2. A positive commanding method of giving directions and instructions.
3. Avoidance of double-meaning terminology and selection of words that convey meaning for *all* types of cars used.
4. Prefacing commands with "all cars" or "car number —" depending on whose attention is desired.
5. Limiting directions to essentials, thereby developing greater self-reliance on the part of students.
6. Knowledge of facility's potential "trouble spots" (e.g., a tight turning space, a stretch of roadway where sunblinding is possible, etc.) and initiating of appropriate actions.
7. Alerting students to special defensive driving tips and providing precautionary suggestions.
8. Special arrangements for students unable to safely perform and profit from the typical multiple-car instructional program.
9. A soundly-conceived "emergency plan" and a calm, competent manner of executing it, should the need arise.
10. Avoiding excessive talking.
11. Limiting criticism to constructive types.

Number of Students Per Vehicle: The number of students assigned to a car can vary from one to as many as three or four. When more than two students are scheduled per vehicle, the reason is often for scheduling expediency rather than learning value. Any observer time scheduled beyond the amount resulting from two students being assigned per car (one driver and one observer) is difficult to justify from a learning viewpoint. Teachers scheduling two students per vehicle (one as a driver) stress two advantages of this arrangement: (a) by sharing the class hour, neither student drives "too long" at one session; and (b) absenteeism does not reduce the number of cars in operation (as in a one-student per-car arrangement) and actually provides more driving time for students needing additional or special experience.

When two students are assigned per vehicle the role of the non-driving student assumes an active role as a student aide.

Evaluation

Although several evaluative instruments are available to help measure driving ability, this continues to be one of the instructor's most important and difficult tasks. Most instruments are geared to some standard of manipulative skill and rely upon the individual teacher-evaluator to subtract or add "points," based on observation of the learner. Provision is also made for assessing the student's identification, prediction, decision-making, and execution in traffic, and attitudinal-emotional factors. The activities performed on a comprehensive multiple-car facility lend themselves readily to assessment in each of the above areas if certain evaluative criteria are established.

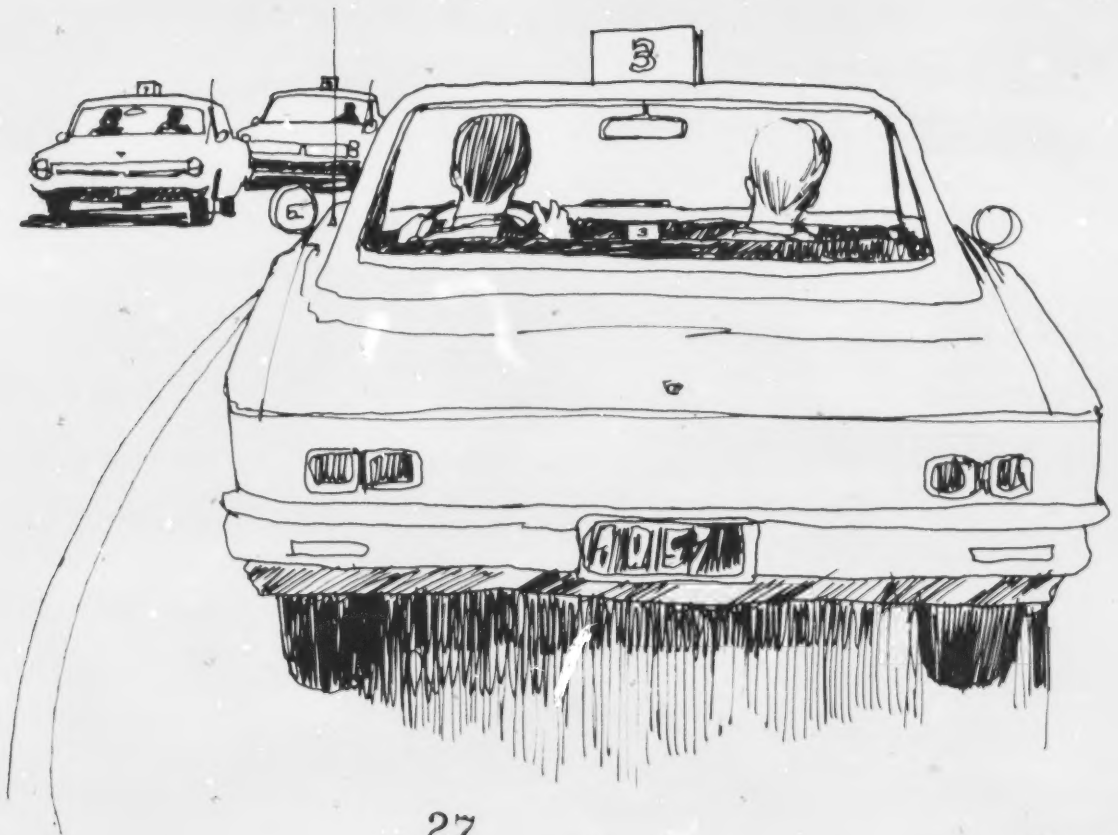
Appendix E and F present two types of evaluation forms employed to measure (1) basic manipulative skills and (2) identification, prediction, decision-making, and execution abilities in traffic mix situations. A combination of these two forms is most desirable. Your specific evaluation form will be determined by your instructional objectives.

Student attention and hazard recognition involve not only seeing, but also interpreting the significance of what has been observed. The following specific criteria can be used to evaluate and grade this particular phase of the student's driving:

A. Good sensory faculties or is conscious of limitations and adequately compensates.
B. Good concentration—not easily distracted by conditions within or outside the vehicle.
C. Proper use of eyes, to survey the traffic scene.
D. Makes quick, accurate observation and interpretation of conditions around him.

After recognizing a potentially hazardous condition ahead, the student must decide what action is needed. This decision will necessitate the selection of a strategic maneuver or evasive action that is in accord with traffic laws or regulations, consistent with physical laws of nature, and based on sound driving practices in general. It is important for driver educators to develop and evaluate this type of decision-making performance in traffic.

Some of the behavioral tendencies which affect driving performance are listed below. Opportunities for evaluating these traits will arise mostly in the laboratory setting, but classroom activities may also reveal traits related to the learner's social-emotional fitness for driving. It is just as important to help students understand their attitudinal or emotional weakness as it is to help them evaluate skill performance in executing right and left turns.



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An affirmative rating indicates desirable growth and is dependent upon how effectively a student shows:

1. willingness to make timely adjustments even if it means giving up right-of-way or compensating for another's error;
2. accepts and profits from relevant criticisms of performance as opposed to "know-it-all" attitude;
3. calmness and alertness under difficult situations as opposed to being nervous, impatient, irritable or upset;
4. exhibits a suitable degree of confidence . . . as opposed to overconfidence or overcautiousness;
5. keeps inner distractions, unrelated to driving, from unduly affecting learning and driver performance (anxieties, successes, failures, relation to other sex, etc.);
6. prevents mistakes, near-mishaps, and similar actions from seriously reducing subsequent driving efficiency;
7. displays tolerant, cooperative, and courteous behavior toward others and their mistakes;
8. gives no indication that the auto will be used in an unsafe manner to satisfy unmet needs;
9. possesses a realistic image of self-concept of personal strengths and limitations and appropriately compensates for shortcomings when driving; and/or
10. appreciates and respects the basic purposes and procedures of traffic law and enforcement (21).

The properly prepared instructor can recognize traits in students that may indicate behavior problems. These potential problems can often be corrected by having the instructor explain their significance to the student. In the more extreme cases, it may be necessary to refer the student to other school personnel or to an outside agency better equipped to provide special training.

Observation of pupil behavior is sometimes criticized as being "too subjective." Nevertheless, reasonable alternatives are often non-existent. Moreover, it is possible to "be objective about subjective observations" through such techniques as: (a) keeping an anecdotal file on each student, with specific reference to obvious positive or negative behavior habits; (b) keeping a running record of observations and on-the-spot evaluations made of student skill, knowledge and attitudinal development. By following such a procedure a reasonably comprehensive and realistic evaluation of student behavior can be achieved.

Teacher Preparation

The success or failure of the multiple-car method, like other aspects of the driver education program, is in the hands of the teachers involved. Systematic efforts should be made to inform teachers about multiple-car instruction and provide supervised experience in its actual use.

For some teachers, particularly those with a limited formal course background, this may mean returning to college for additional training.

For other teachers, a non-credit program may suffice. Such programs are often available through colleges and universities, the state education department, the state driver education association, the local school district, a combination of school districts, or a combination of several of these institutions and agencies.

Ideally, teachers should become knowledgeable about the method while taking pre-service training. Unfortunately, however, many teacher preparation programs limit laboratory experience to the on-street method.

In view of the changing nature of driver education, and the need for teachers experienced in all phases of laboratory instruction, colleges and universities cannot realistically prepare teachers for only one type of instructional approach.

College and university teacher preparation programs should strive to develop teachers who have the ability to:

—identify the contributions that multiple-car instruction can make to the acquisition of driving competency;

—select content and teaching strategies;

—demonstrate effective teaching techniques on the multiple-car facility with a group of beginning drivers;

—formulate a schedule which coordinates multiple-car instruction within the driver education program; and

—select necessary equipment used on the multiple-car facility, install designated equipment and perform simple non-technical maintenance of this equipment.

Conclusion

In a little more than three decades high school driver education has grown from a single-purpose experimental course offered in one public school to a multi-faceted program considered part of the regular curriculum in more than 642 public schools. It was available to but a few young people in 1933, whereas during the 1970–71 school year enrollment totaled more than 1.5 million students (18).

The nature of high school driver education has also changed. Of the innovations in the laboratory portion of the course, simulation and the multiple-car method are perhaps the most prominent.

An attempt has been made in this publication to present and interpret what is known about the multiple-car method of instruction. The contents are based both on professional judgment resulting from experience and from documented research. The objective has been to assemble in one publication information useful to those considering or adopting the multiple-car method as part of their driver education program.

With an increasing awareness of the importance of high school driver education on the part of educators, legislators, and the public at large, the continued growth of quality driver education is imperative. As noted earlier, one measure of the importance attached to driver education today can be found in the Highway Safety Act of 1966. The United States is not alone in its adoption of newer innovations such as the multiple-car method. This approach is in use both in Canada and Australia, to cite but two examples (9,14).

Application of the multiple-car method in its present stage of development is playing an important role in meeting future cost-quality-quantity needs in driver education. The years ahead may see many improvements over today's skill and/or traffic mix facilities. If this publication in any way contributes to such a development, those who have been associated with its preparation will consider their efforts well rewarded.

A possibility for the future will be the strengthening of instruction for driving under adverse weather conditions in handling emergency driving situations. Where high school driver education courses have given attention to these matters, the approach has traditionally been almost completely confined to classroom information and discussion. There is evidence and much growing concern that this approach is insufficient. In the future, more multiple-car facilities will be designed to include such innovations as a "skid pan" area where recovery from skidding and other emergency maneuvers can be learned under realistic yet safe, well-supervised conditions.

This is but one example; there are others. Whatever the future may hold for high school driver education, it is important for educators to cultivate and exercise a continuous and critical evaluation of their instructional programs. Keeping in mind that the overarching goal of driver and traffic safety education is to improve the quality of human decisions and performance tasks related to the system in a manner that encourages continuing improvement (3), it is hoped that this publication will assist educators in achieving this goal. At best it can only assist for:

> No curriculum has much meaning until the teacher brings it to life in the school setting. The teacher, more than any other individual, determines whether the learners actually benefit by the activities and opportunities which the curriculum makers have planned (16).

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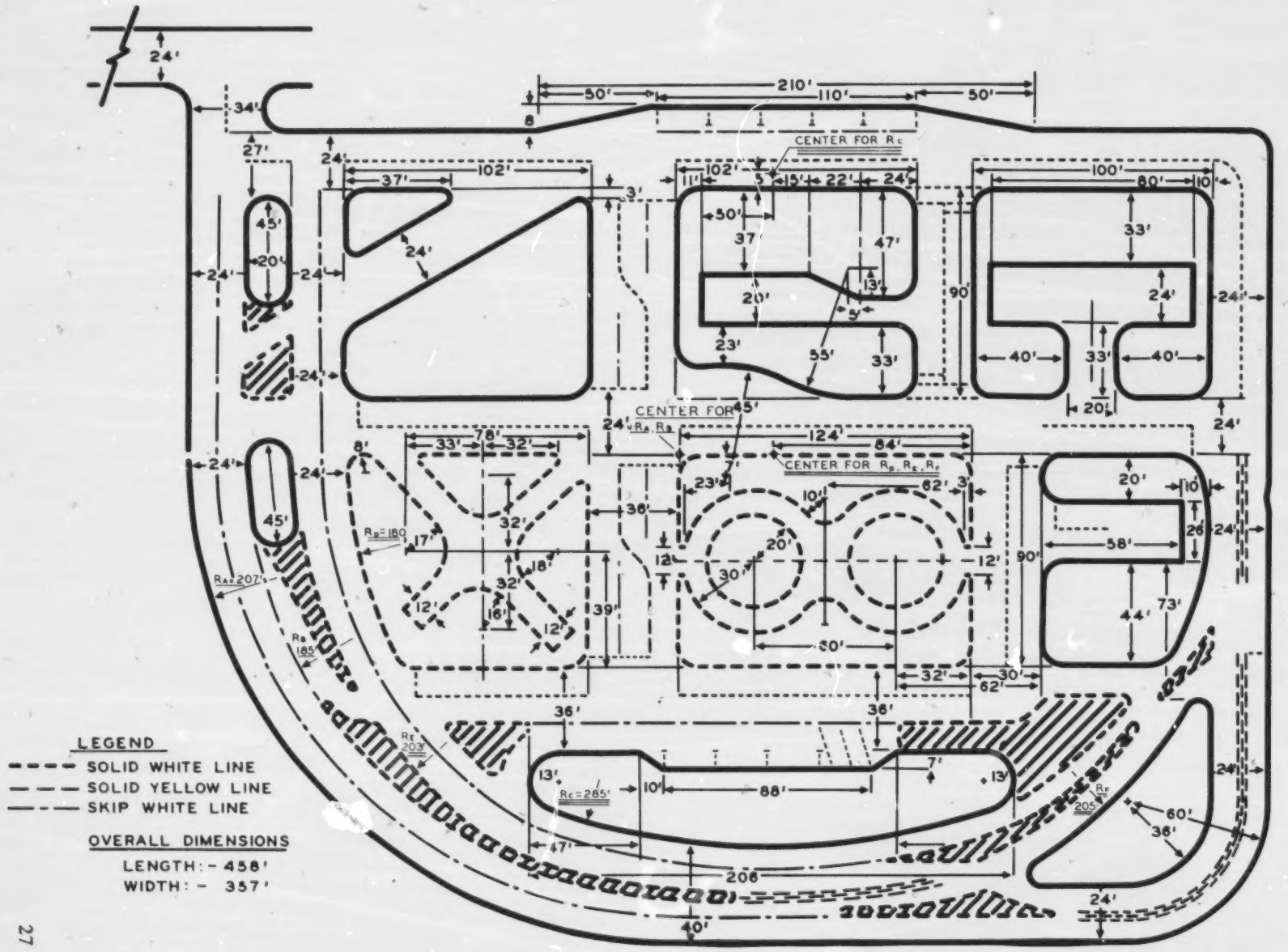
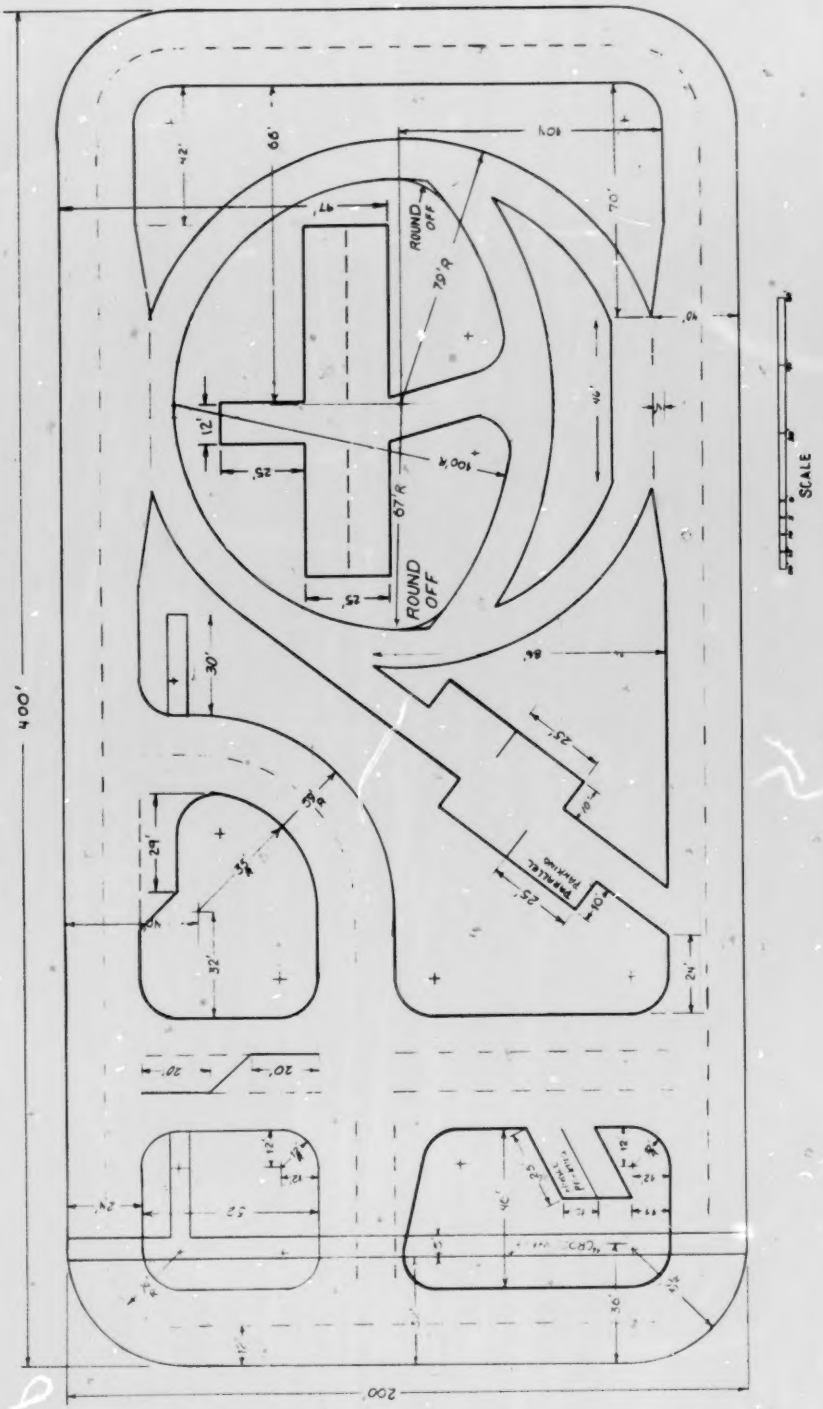
Appendix A

MICHIGAN STATE UNIVERSITY MULTIPLE-CAR FACILITY
EAST LANSING, MICHIGAN



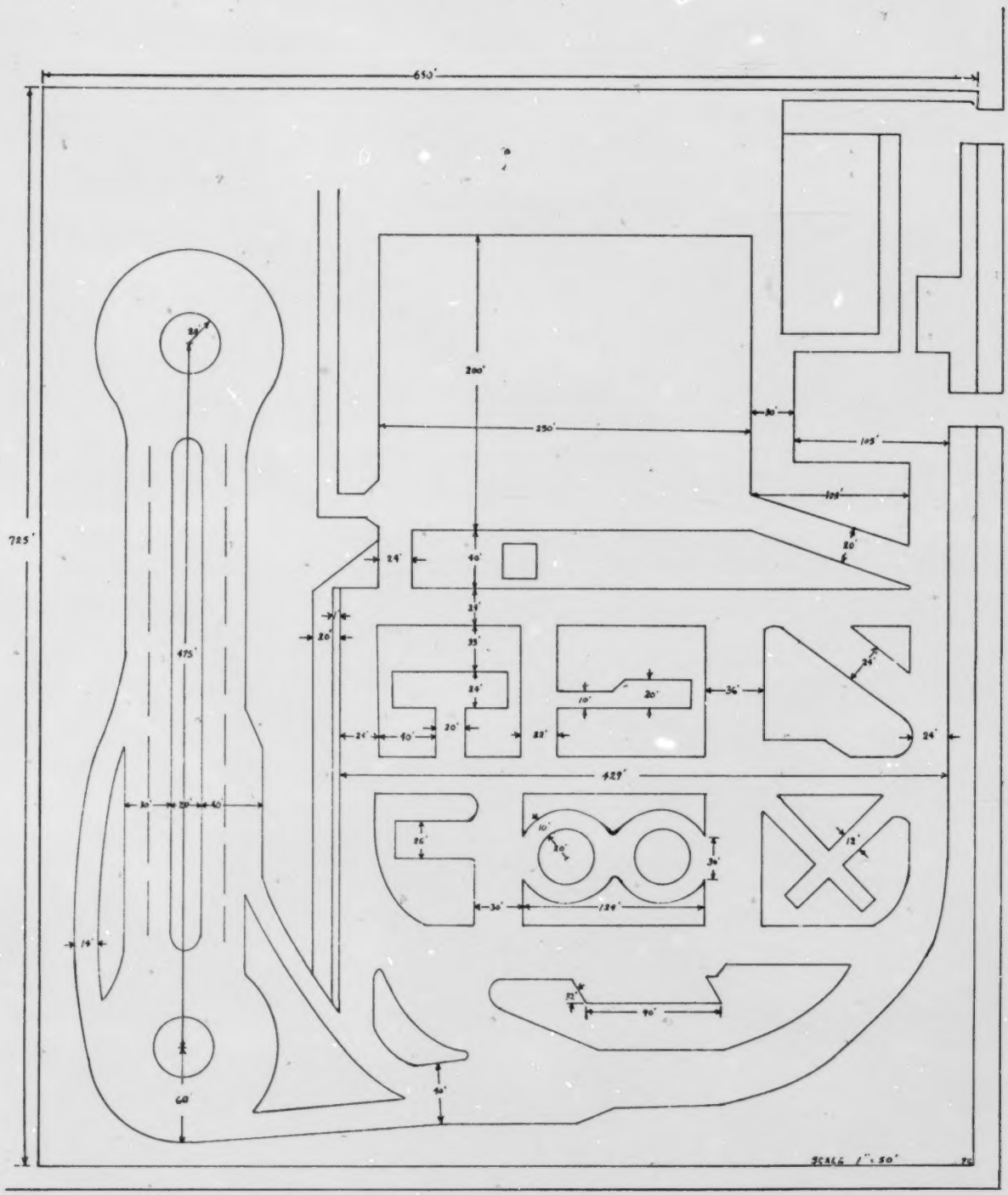
Appendix B

ILLINOIS STATE UNIVERSITY
MULTIPLE-CAR FACILITY
NORMAL, ILLINOIS



Appendix C

CENTRAL MISSOURI STATE COLLEGE
MULTIPLE-CAR FACILITY
WARRENSBURG, MISSOURI



Appendix D

Exercise Procedures

A brief description of seven practice situations is offered to assist teachers in understanding the purposes of the exercises and maneuvers.

1. Lane Changing Exercises
   This exercise is designed to teach a student the proper procedure for changing lanes, whether in anticipation of making a turn or continuing straight ahead. In making a lane change, the driver is required to check traffic to the rear, give a proper signal, check the blind spot, and then accelerate moderately into the new lane, after which he adjusts his speed.

2. The "T" Exercise
   This exercise derives its name from the basic shape of the driving area. A flag attached to a four-foot stanchion, and representing a fixed object such as a parked automobile, or a parking meter, is found at either end of the top portion of the "T." This exercise helps develop skills needed to control the car moving slowly toward one flag, stopping when within a distance of 12 inches from the flag, and then proceeding slowly forward to a distance of three inches from the flag and stopping again. This movement is then repeated in reverse toward the other flag at the opposite end of the "T."

3. The "Figure 8" Exercise
   This exercise helps develop correct hand-over-hand steering techniques. As the vehicle moves slowly through the exercise, the driver practices hand-over-hand steering in order to keep his car within the lane lines. Driving through this exercise in reverse may be assigned some students, but it is generally not required of all.

4. The "X" Exercise
   This exercise also derives its name from the shape of the area on which it is practiced, and is used to reinforce skills learned on the "T" exercise. The "X" exercise develops backing and turning skills by requiring the driver to maintain the vehicle within lane lines while backing in a straight line to the intersecting point of the "X," then negotiating a rear turn into the designated lane. Other variations are also possible.

5. The Double Garage Exercise
   The floor pattern of a double garage served by a single-lane driveway is duplicated with flags representing the forward wall and the rear center post. This exercise develops the student's ability to back out of a garage into a narrow single-lane driveway leading to the street. Backing safely into the correct traveling lane on the street completes the exercise.

6. Parking on a Hill
   This exercise gives the driver experience in correctly parking a car on either an up-grade or a down-grade. When parking a vehicle on a down-grade, the driver is instructed to position the car parallel to, and approximately six inches from, the curb, with the front wheels turned to the right. On an up-grade, the vehicle is similarly positioned with the front wheels turned to the left. In either case, the front wheels are turned to prevent the car from rolling forward or backward should the parking brake become disengaged. This exercise area is also useful for developing skills associated with hill starting and stopping movements.

7. The "Y" Turn Exercise
   A deadend street with a distance of 26 feet from curb face to curb face is representative of the area on which the "Y" turn is practiced. The driver is required to turn his car around from a stopped or parked position using three movements: First, forward and to the left side of the street; next, to the rear by backing to the right; and finally, driving forward to the left and into the proper lane.

Appendix E

Multiple-Car Facility
Skills and Procedure Evaluation Check Sheets

Name..... Semester..... Period..... Date.....

A. *Starting Procedure*
1. Checks around car before entering _____
2. Adjusts seat and mirrors _____
3. Selection of gear—"P" or "N" _____
4. Seat belt fastened _____
5. Foot on brake _____
6. Switch on—to start—release _____

B. *Moving the Car*
1. Foot on brake _____
2. Selects proper gear _____
3. Release parking brake _____
4. Signals _____
5. Traffic check _____
6. Release brake _____
7. Proper acceleration _____

C. *Left Turn*
1. Slows down _____
2. Proper lane position _____
3. Signals _____
4. Checks traffic _____
5. Hand-over-hand turning _____
6. Turns into proper lane _____
7. Recovery _____

D. *Right Turn*
1. Slows down _____
2. Proper position _____
3. Signals _____
4. Checks traffic _____
5. Hand-over-hand turning _____
6. Turns into proper lane _____
7. Recovery _____

E. *"T"*
1. Signals for entry _____
2. Enters via proper lane _____
3. Stops proper distance from flag #1 _____
4. Correct backing technique _____
5. Stops proper distance from flag #2 _____
6. Leaves via correct lane _____
7. Stops and checks before entering street _____

F. *"X"*
1. Signals for entry _____
2. Enters via correct lane _____
3. Hand-over-hand turning _____
4. Stops proper distance from flag #1 _____
5. Correct backing technique _____
6. Doesn't turn wheels while car is still _____
7. Stops correct distance from flag #2 _____
8. Stops and checks before entering street _____

G. *Garage*
1. Signals for entry _____
2. Correct backing distance _____
3. Stops—traffic check _____
4. Turns into correct lane _____
5. Doesn't turn wheels while car is still _____
6. Looks to rear while car moves to rear _____
7. Clears lane—moves ahead _____

H. *"Y" Turn*
1. Signals for entry _____
2. Brings car to full stop—proper lane _____
3. Traffic check _____
4. Signal (left) _____
5. Correct turning procedure _____
6. Stops car just before reaching other side—permits car to roll forward slowly, straightening wheel as he does so _____
7. Moves to rear—correct turning procedure _____
8. Stops before reaching curb—permits car to roll backward slowly straightening wheels as he does so _____
9. Moves car forward—correct turning procedure _____
10. Stops—signals before leaving _____

I. *Parking on Hill*
1. Signals for stop _____
2. Stops correct distance from curb _____
3. Turns wheels in or out depending on grade _____
4. Sets parking brake _____
5. Puts selector lever in "P" (ignition off) _____

J. *Angle Parking*
1. Traffic check _____
2. Car position _____
3. Signals _____
4. Moves car into stall—good spacing; does not strike curb _____
5. Backs out (straight) _____
6. Pause—checks traffic _____
7. Checks left front and right rear fender clearance _____
8. Turns into proper lane—looks to rear _____
9. Straightens wheels before car stops moving _____
10. Clears lane _____

K. *Parallel Parking*
1. Traffic check—signal _____
2. Stopping position _____
3. As car moves to the rear, turns wheels all the way to the right _____
4. When center door post is in line with rear bumper, begins straightening wheels _____
5. When front bumper is even with the rear bumper of the other car, begins turning all the way to the left _____

6. Continually checks front and rear as he enters parking stall _____
7. Centers car in stall _____
8. Proper distance from curb _____
9. Traffic check and signal _____
10. Clears stall correctly _____
11. Makes right front fender check _____
12. Makes center door post check _____
13. Turns correctly into proper lane _____

L. *Lane Changing*

1. Traffic check (mirrors and over shoulder) _____
2. Signal _____
3. Checks blind spot _____
4. Enters new lane correctly _____

M. *Passing*

1. Traffic check (mirrors and over shoulder) _____
2. Signals—directional signal and horn _____
3. Proper acceleration—makes pass _____
4. Mirror check—signal _____
5. Returns to lane correctly _____
6. Resumes speed _____

Appendix F

CHECKLIST FOR EVALUATION OF DRIVERS

	YES	NO
Pre-Drive		
1. Lock doors and adjust windows	____	____
2. Place key in ignition	____	____
3. Adjust seat	____	____
4. Adjust mirrors	____	____
5. Fasten seat belt	____	____
6. Park brake "on"	____	____
Starting Procedures		
1. Selector *lever to "n"*	____	____
2. *Foot* presses down *on brake*	____	____
3. Right foot presses down gas and releases to *set automatic choke*	____	____
4. Turn ignition *key to start* and release	____	____
5. Allow *engine to idle* until running smoothly	____	____
Moving Car From Parked Position		
1. *Foot* presses *on brake*	____	____
2. Foot releases pressure on *gas pedal*	____	____
3. *Selector lever* to "D" or "R"	____	____
4. Release *park brake*	____	____
5. *Check mirrors* for traffic	____	____
6. Give proper *signal*	____	____
7. Glance over proper shoulder	____	____
8. *Foot off brake*	____	____
9. Foot presses gently on *gas pedal*	____	____
10. Slight left or right turn as needed	____	____
11. *Select* desired *lane*	____	____
Lane Behavior		
1. Blends with traffic, car centered in appropriate lane	____	____
2. Maintains sufficient following distance to avoid sudden emergency stops	____	____
3. Changes lanes only when necessary	____	____
4. Observes traffic conditions and signals intentions before changing lanes	____	____
Sees Delays Well in Advance		
1. Sees traffic tie-ups ahead in time to avoid delays by changing lanes	____	____
2. Sees problems facing other drivers so is expecting their next move	____	____
3. Times traffic lights well	____	____
Disposes of Hazards Promptly		
1. When unsure of the intentions of someone along the road, adjusts speed or changes lanes or taps horn—or does all three things if necessary	____	____

	YES	NO
Safe Speed Near Intersections		
1. Adjusts speed on approaching intersections so he could avoid a crash if a side-street driver failed to stop or an oncoming car turned left across his path. Safety speed here depends on whether he has swerving space	____	____
Identification Abilities		
1. Conscious of psychophysical limitations	____	____
2. Alertness and awareness		
a. Selects most significant events	____	____
b. Good concentration	____	____
c. Not easily distracted	____	____
3. Efficient eye habits	____	____
4. Accurate observation and interpretation of events		
a. Signs, signals, and markings	____	____
b. Roadway characteristics	____	____
c. Other users	____	____
5. Recognition of critical cues and hazards	____	____
Adequate and Accurate Predictions		
1. Estimates of distance, speed, direction, and time	____	____
2. Predictions of other road users' behavior	____	____
3. Evaluation of alternatives and risks	____	____
4. Achieves proper time-space placement of vehicle	____	____
Decision-Making and Execution Abilities in Traffic Mix Situation		
1. Communicates intentions early and is sure others are aware of the e plans	____	____
2. Keeps control of traffic situation in own hands and does not rely on others	____	____
3. Anticipates and adjusts to actions of other highway users	____	____
4. Blends well with traffic; makes moves gradual and smooth	____	____
5. Performs safely and efficiently at intersections and other right-of-way situations	____	____
6. Action in accord with state and local laws and rules	____	____
7. Actions consistent with physical laws of nature and sound driving practices	____	____
8. Reacts calmly and quickly to unforeseen emergencies or hazardous conditions	____	____

Appendix G

General Rules for the Multiple-Car Area

1. Driving is not a part-time job; prepare yourself well, read assigned materials thoroughly, learn the fundamentals; give full attention and effort to the task.
2. Do not drive if you are not feeling well or are extremely nervous.
3. Drive only on roads or practice exercises that have been demonstrated or "opened" to your group.
4. If you do not understand a newly introduced exercise, ask for further explanation immediately!
5. Always make proper observations and visual checks before moving your vehicle. Never make any move that cannot be made safely.
6. Drive your car at a speed that is reasonable and proper under the circumstances. (Top speed of — MPH during the first two lessons will be changed later.) Observe posted speed limits.
7. Be alert, allow as few distractions as possible and obey all traffic control devices.
8. Never overtake and pass another vehicle proceeding in the same direction on a two-lane street unless directed to do so by your instructor.
9. Be able to stop in time, and maintain a reasonable distance between yourself and the vehicle ahead.
10. Always stop and check traffic before driving out of any exercise area.
11. You are entrusted with the care and operation of a very expensive piece of equipment—conduct yourself accordingly.

Appendix H

Practice Driving Guide Lesson Number 1

Aims and objectives: To assist students in the development of the following procedures and skills. A) pre-ignition procedure, B) starting procedure, C) stopping procedure, D) steering procedure, E) techniques for moving forward, F) procedure for making left hand turns.

Procedure "A": Pre-Ignition

1. Enter car from protected side.
2. Put key into ignition.
3. Check and lock doors.
4. Adjust seat and mirrors.
5. Adjust head rest.
6. Fasten seat belt.
7. Gear selector lever in "park."

Procedure "B": Starting the Car

1. Foot on brake.
2. Selector lever to "neutral" or "park."
3. Key to "on" position.
4. Check all gauges.
5. Depress gas pedal slightly.
6. Key to "start" position.
7. When engine starts, release key and gas pedal.
8. Recheck all gauges.
9. Selector lever to "drive."
10. Release parking brake.
11. Check traffic—front, sides, and rear.
12. Signal.
13. Check over left shoulder.
14. Remove foot from brake.
15. Apply soft gas, proceed cautiously.

Procedure "C": Stopping the Car

1. Check traffic behind—use mirrors.
2. Signal—pump brake pedal.
3. Release gas pedal.
4. Apply soft brake.
5. After stopping, put selector lever in "park."
6. Set parking brake.
7. Key to lock position.
8. Remove key.
9. Leave car—exercise caution.

Procedure "D": Steering the Car

1. Forward—hands at 10-2 position.
2. Backward—left hand on top of wheel, look over right shoulder, aim at distant target.

Procedure "E": Driving Forward

1. Purpose of this exercise is to get the feel of the car.
2. *Procedure:*
   a. Drive forward to first flag line using correct starting and stopping procedures.
   b. Drive forward to second flag line.
3. *Points of Emphasis:*
   a. Car control.
   b. Smooth, gentle acceleration.
   c. Smooth, even braking.
   d. Stopping even with line.

Procedure "F": Left Hand Turns:

1. Start first student around area counter-clockwise. Talk him through the proper procedure while other students observe.
2. *Procedure for Left Turns:*
   a. Check mirrors.
   b. Signal.
   c. Position vehicle.
   d. Reduce speed.
   e. Brake.
   f. Check traffic.
   g. Turn—hand-over-hand steering technique.
   h. Unwind by allowing wheel to slip through hands. (Power steering must be turned back.)
   i. Enter proper lane.
   j. Accelerate slightly about half-way through turn.
3. *Points to Emphasize:*
   a. Maintain distance of three car lengths apart.
   b. When the car in front of you stops, you stop.
   c. Smooth acceleration and braking.
   d. Signal and slow down for all turns.
   e. Use hand-over-hand steering techniques.
   f. Maximum speed—10 MPH first two periods.

Appendix I

The "Integrated" Laboratory Scheduling Plan

In the "integrated" laboratory scheduling approach, experience on the multiple-car facility alternates with experience in an on-street setting. Those who have used this method believe that a better learning situation results when students are given early opportunity to put into practice in actual traffic what they have learned in an off-street situation.

Proponents of this plan recommend that a student receive 2–4 periods of multiple-car instruction and then alternate each fourth or fifth period of multiple-car experience with on-street instruction. Each succeeding session on the facility, therefore, is designed to acquaint the student with a specific type of situation to be encountered on the street under different driving conditions. Experiences usually start with basic turns and progress through special left- and right-turn lanes, merging, turn-about, passing, one wheel dropping off the pavement and so forth.

This approach tends to reduce the possibility of monotony and provides the student an opportunity to practice those maneuvers for which actual experience has demonstrated a specific need.

The scheduling advantages of such a program arise out of the fact that a larger block of students can be assigned to driver education at a given time. All students are thus assigned to classroom and laboratory instruction concurrently. To illustrate, we will schedule 60 students into a 60-minute period, 12 weeks in length, utilizing 12 cars on the multiple-car facility, plus two cars on the street, and a staff of four full-time instructors.

The class of 60 students is divided into two groups, "A" and "B," of 30 students each. The first two days all students are in classroom session either in one or two groups. All four instructors are also in the classroom on these first two days. Beginning the third day, groups "A" and "B" alternate from classroom to laboratory instruction daily.

Utilizing one teacher in charge of the multiple-car facility plus two teachers from the on-street program as "assistant instructors," all students in a given laboratory group receive instruction on the facility during the first two laboratory lessons. During these first two days, student progress and ability is evaluated very closely by all three instructors, and students are then sub-divided tentatively into on-street driving groups of three students each. From this date on, six students (two laboratory subgroups) in each laboratory period are rotated off the area onto the street. This means that from the seventh through the forty-second day one instructor is on the facility and two instructors are on-the-street. Adjustment may be made in any laboratory subgroup any time that any one of the instructors feels it is necessary.

The instructor in charge of the multiple-car facility may assist in directing group discussion, class demonstration or other classroom activities, or with on-the-street instruction after completing the multiple-car assignment. His multiple-car assignment is completed on the forty-second day; this leaves an additional 18 days before the "cycle" is completed.

It is possible by using the above formula to adjust a program to a class period of almost any length, or any time block. The example used above would enable four instructors to provide a totally coordinated program to 900 students during a school year of 180 actual school days, teaching a class load of five one-hour periods per day, without recourse to study halls or other conflicts, and tying all phases into a meaningful whole.

To require all students to complete their multiple-car experience prior to going onto the street ("segregated" approach) necessitates: (1) having three instructors on the area for a period of 34 days using 14 cars, or else reassigning teachers from some other subject matter fields whenever they are needed; and (2) assuming that the same three instructors handle the on-street instruction, an additional 40 days are required to provide the necessary experience for all students. If use is made of study hall periods and all four instructors teach students on the street after the sixtieth day, a total of 74 days are needed to offer the total program as contrasted to 60 days in the "integrated" approach.